DOCUMENT RESUME

ED 039 121 | SE 007 471

TITLE	Human Body (Physiology), K-6.
INSTITUTION	Bethlehem Area Schools, Pa.
PUB DATE	69
NOTE	191p.
EDRS PRICE	EDRS Price MF-$0.75 HC Not Available from EDRS.
DESCRIPTORS	*Biology, *Elementary School Science, Human Body, *Instructional Materials, Physiology, *Science Activities, Teaching Guides
IDENTIFIERS	Bethlehem Area School District

ABSTRACT

The physiology of the human body is one of eight subject areas covered in the K-6 Science Program of the Bethlehem Area School District. This manual is a teacher's guide to activities for each grade level. "Awareness of Senses" is treated in Kindergarten, "Body Growth and Development" in grade 1, "The Senses and Their Function" in grade 2, "The Ear" in grade 3, "Body Structure" in grade 4, "Body Systems" in grade 5, and "The Eye" in grade 6. It is intended that more emphasis be given to the human body in grades 1, 2, 4, and 5 (4 to 6 weeks) and less in grades K, 3, and 6 (2 to 4 weeks). The section for each grade first lists "understandings to be discovered" keyed to related activities. Each activity is introduced by a "leading question" followed by a list of materials and a description of an activity designed to answer the question. Many of the activities require students to manipulate materials, other suggest demonstrations, examination of models or charts on the use of reference materials. The sections for grades 3 and 4 also suggest assignments for homework or individual research. The activities are designed to give information and develop concepts (another unit used in each grade is designed to develop science processes). A flow chart is provided showing the overall plan of the Elementary Science Program, and an appendix contains tables of nutritional requirements, and a summary of digestion. [Not available in hardcopy due to marginal legibility of original document.] (EB)

HUMAN BODY

(Physiology)

K – 6

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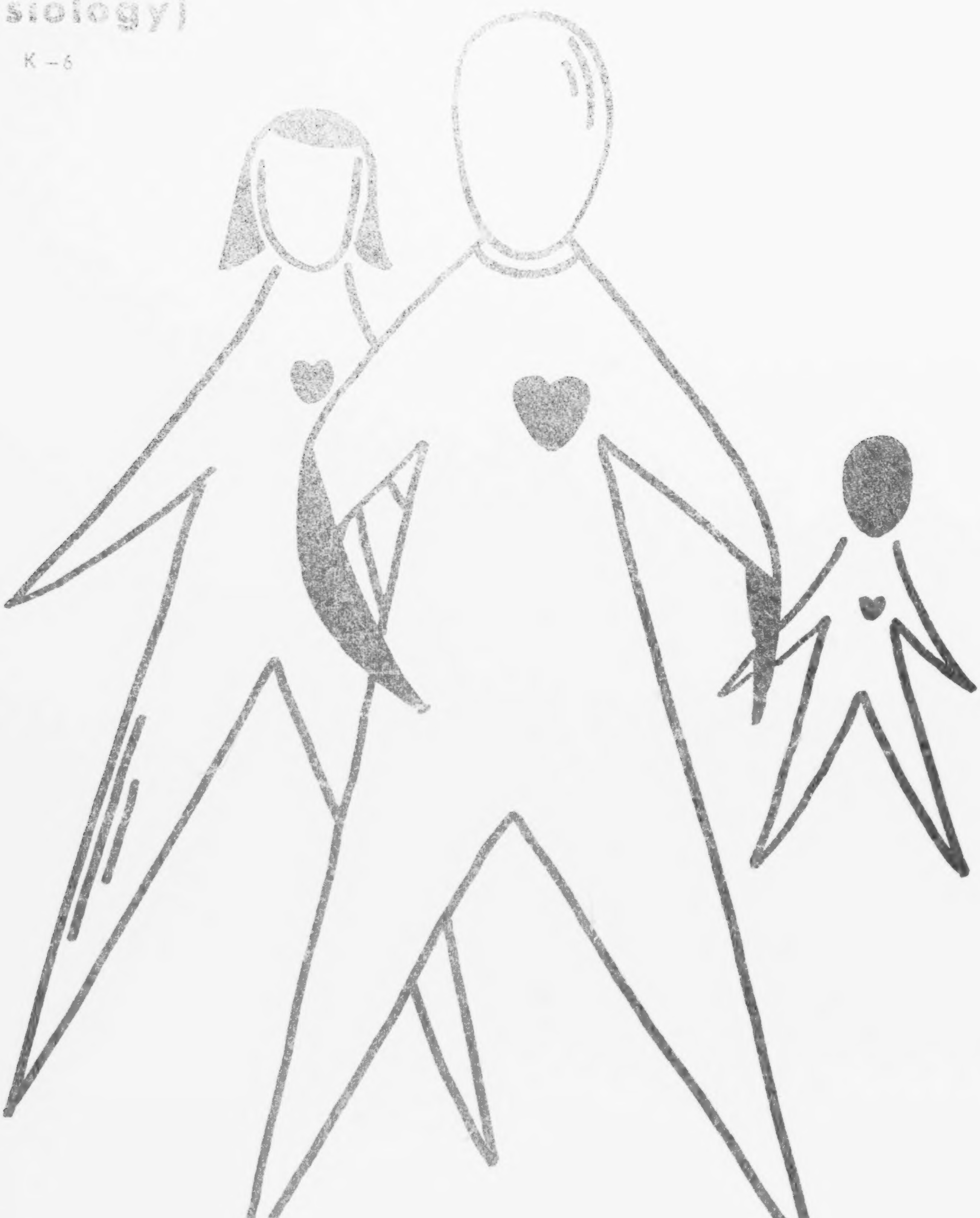

Elementary Science Unit No. 5
1968

Bethlehem Area School District
Bethlehem, Pennsylvania

ED039121

HUMAN BODY

(Physiology)

K-6

BETHLEHEM AREA ELEMENTARY SCHOOLS

Bethlehem Area School District
Bethlehem, Pennsylvania

1969

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Elementary Science SCOPE AND SEQUENCE K-6 Bethlehem Area School District

UNIT	KINDERGARTEN	GRADE 1	GRADE 2	GRADE 3	GRADE 4	GRADE 5	GRADE 6
SPACE SCIENCE	Our Wonderful Sun	*Earth in Space - Earth - Moon - Sun and other Stars	Men and Machines in Space	Movements of the Earth and Moon - Seasons - Gravity	*Our Great Universe - Earth - Moon - Sun's Family - Celestial Bodies - Universe - Early Astronomers		*From Atmosphere to Space - Force, Energy and Power - Distance in Space - Flight and Space Travel
DIGGERS TO DIVERS (Geology)	Our Useful Rocks			*Rocks - Then and Now - Earth-its Formation - Soil-its Properties - Sedimentary Rocks - Uses of Rocks and Minerals	*Petrology - Rocks, Minerals, Soil - Landforms - Paleontology - County and State Geology	*Oceanography - Exploring the Oceans - Geological Oceanography - Physical Oceanography - Chemical Oceanography - Biological Oceanography - Uses of the Ocean	*Geology - Geologic Changes - Glaciers - Streams - Water - Current Problems and Studies
SCIENTIFIC METHOD (Processes)	Process - Classifying - Observing - Predicting - Interpreting Data - Experimenting	Process - Classifying - Observing - Predicting - Interpreting Data - Measuring - Experimenting	Process - Classifying - Observing - Predicting - Interpreting Data - Estimating - Measuring - Using Numbers - Experimenting	Process - Classifying - Inferring - Observing - Predicting - Interpreting Data - Measuring - Using Numbers - Experimenting	Process - Classifying - Inferring - Observing - Predicting - Interpreting Data - Measuring - Using Numbers - Experimenting - Controlling Variables	Process - Classifying - Inferring - Observing - Predicting - Interpreting Data - Estimating - Measuring - Using Numbers - Experimenting - Controlling Variables	Process - Classifying - Inferring - Observing - Predicting - Interpreting Data - Estimating - Measuring - Using Numbers - Experimenting - Controlling Variables
NATURE OF MATTER (Chemistry)	Discovering Matter	*Matter Around Us - States of Matter - Changes of Matter			*Changes in Matter - Molecular Theory - Physical and Chemical Change - Compounds and Mixtures		*Atoms and Molecules - Nature of the Molecule - Nature of the Atom
HUMAN BODY (Physiology)	Awareness of Senses	Body Growth and Development	The Senses and Their Function	The Ear - The Organ of Hearing	*Body Structure - Cells - Skin - Muscle - Skeleton	*Body Systems - Nervous - Respiratory - Digestive - Circulatory - Excretory - Endocrine - Heredity	The Eye - The Organ of Seeing
ENERGY Magnet. & Elect	Discovering Magnets	Jumping Elect.		Flowing Electricity			
Light	Light, Color and Shadows		*Light in our World				Control and Measurement Light & How We Use It
Heat	Hot, Warm & Cold		Temperature Control		Fire & Fire Prevention	Measurement of Heat	
Sound	Now Hear This			Using Sounds		Understanding Sound	
Machines	Tools & Work	Force & Motion	*Simple Machines			*Mechanics	
BUGS TO BIOMES (Ecology)	Let's Investigate - Simple Identification - Introduction to Adaptation and Growth - Domestic Animals	*Let's Compare - Types - Comparison - Growth - Homes - Interdependence - Conservation		*Let's Discover - Community Life - Structure and Function - Interdependence - Conservation	Let's Observe - Simple Life - Interdependence - Conservation	Let's Explore - Ocean Community - Interdependence - Conservation	*Let's Classify - Introduction - Spermatophytes - Invertebrates - Vertebrates - Interdependence - Conservation
CLEAR OR CLOUDY (Weather)	Air	Changing Skies - Air is Useful - Weather	More Weather Change - Air - Thermometers - Climate	*Observation & Investigation of Changing Weather - Properties of Air - Weather		*Weather Instruments and Their Uses in Forecasting - The Atmosphere - Weather - Forecasting	

* MAJOR AREAS OF STUDY

TABLE OF CONTENTS

Page

SCIENCE EDITING COMMITTEE 3

FOREWORD 4

Kindergarten AWARENESS OF SENSES
  Understandings to be Discovered 5
  Activities 6

Grade 1 BODY GROWTH AND DEVELOPMENT
  Understandings to be Discovered 14
  Activities
    Week #1 15
    Week #2 23

Grade 2 THE SENSES AND THEIR FUNCTION
  Understandings to be Discovered 25
  Activities 27

Grade 3 THE EAR - THE ORGAN OF HEARING
  Understandings to be Discovered 51
  Activities 53
  Activities to Assign for Homework or Individual Research 87

* Grade 4 BODY STRUCTURE
  CELLS
    Understandings to be Discovered 92
  SKIN
    Understandings to be Discovered 93
  MUSCLES
    Understandings to be Discovered 94
  SKELETON
    Understandings to be Discovered 95

    Activities 96
    Activities to Assign for Homework or Individual Research 115

* Grade 5 BODY SYSTEMS
  NERVOUS SYSTEM
    Understandings to be Discovered 116
  RESPIRATORY SYSTEM
    Understandings to be Discovered 117
  DIGESTIVE SYSTEM
    Understandings to be Discovered 118

* Major Emphasis Study

TABLE OF CONTENTS (continued)

Page

* Grade 5 (continued) BODY SYSTEMS
CIRCULATORY SYSTEM
Understandings to be Discovered 120
EXCRETORY SYSTEM
Understandings to be Discovered 122
ENDOCRINE SYSTEM
Understandings to be Discovered 123

HEREDITY
Understandings to be Discovered 124

Activities 125

Grade 6 THE EYE - THE ORGAN OF SEEING
Understandings to be Discovered 162
Activities . . . .

APPENDIX

Important Minerals 174
Important Vitamins 175
Six Classes of Nutrients Needed by the Body . . . 177
Digestion Summary 178
The "Basic Four" 179

* Major Emphasis Study

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FOREWORD

The Physiology Unit (Human Body) is the fifth of a series of units to be written for the Bethlehem Area Elementary Schools.

In the first two editions of the Science Curriculum Guide a Physiology Unit was not included. The third edition will provide a study of the human body in all grades. Certain grade levels will receive major emphasis study and other grades will receive minor emphasis study. The Physiology Unit will correlate the unit study of science and health. Kindergarten will develop the awareness of senses to the child. First grade compares body growth and development at different time intervals. Second grade emphasizes the function of body senses. Third grade develops the ear, while the fourth grade gets into body movements. The fifth grade develops fully the body systems, while the sixth grade develops the eye.

The Physiology Unit should be studied in depth in the first, second, fourth and fifth grades. Kindergarten, third and sixth grades will study Physiology in less detail or with minor emphasis.

First, second, fourth and fifth grades should spend approximately four to six weeks with material at their prescribed level. Kindergarten, third and sixth grades will spend approximately two to four weeks discussing material at their level.

The unit for each grade in this book will usually contain:

1. UNDERSTANDINGS TO BE DISCOVERED with a cross-reference

2. ACTIVITIES

3. ACTIVITIES TO ASSIGN FOR HOMEWORK OR INDIVIDUAL RESEARCH

The UNDERSTANDINGS TO BE DISCOVERED are listed for teacher reference and to be developed through child-centered activities. A teacher should choose activities that best suit the need of the students. Obviously it would be impractical to use every activity listed.

Do not begin a lesson by stating a concept and proceeding to "prove" it with one or more experiments. Allow children to discover a concept in a learning situation. Children themselves should find solutions when confronted with a problem.

Teach children to observe, draw conclusions from observations, discuss problems with fellow students and other people, and to use a variety of references and audio-visual aid materials. Classroom textbooks should be used as reference materials in addition to the encyclopedias and books found in the library.

HUMAN BODY

KINDERGARTEN

HUMAN BODY

Awareness of Senses | **Kindergarten**

UNDERSTANDINGS TO BE DISCOVERED	RELATED ACTIVITIES
Things are discovered in many different ways through the senses.	1
Seeing is a way to find out.	1, 2, 3, 9, 11, 12
Hearing is a way to find out.	1, 4, 5, 6, 7, 8
Smelling is a way to find out.	1, 9
Tasting is a way to find out.	1, 10, 11, 12
Feeling is a way to find out.	1, 2, 3, 13, 14

HUMAN BODY

Awareness of Senses

Kindergarten

ACTIVITIES

1. Leading Question: How do we find out about things?

A. Materials: Popcorn, equipment for popping corn, field corn, paper bag

Procedure: Arrange to pop corn out of sight while children are resting on their rugs or are busily engaged in an activity. What is happening? Bring in corn popper. Children will enjoy watching the corn pop and will enjoy the tasting party.

Why was there a noise? Blow up paper bag. Explode the bag.

Why doesn't all corn pop? Use ordinary field corn and popcorn. Heat both. What happens?

How much bigger does the corn get when it is popped?

B. Materials: Cardboard, construction paper

Procedure: Make a weather chart. Ask the children to indicate the changes relating to each sense that has occurred with the change in the weather or season. (Crunching leaves, wind blowing, snowing, raining, spring flowers, fog, etc.

C. Materials: Flannel board, various shapes, colors, sizes

Procedure: Place the various items on the flannel board. What shapes are the same? Which is larger? Smaller? Which color is different? Does the color change the shape? Does the shape change the color?

D. Materials: The Three Bears (three different sized bears, bowls, spoons, beds, chairs, woods, house, Goldilocks)

Procedure: Tell the story of the three bears. Excellent for introducing the five senses.

2. Leading Question: How do your eyes help you?

A. Materials: Donkey game, Clown game, pins, blindfold

Procedure: Blindfold the youngster. Have him pin a tail on the donkey or a nose on the clown. Remove the blindfold. Would it be easier to find the correct place if one were not blindfolded? Why?

B. Materials: Crayons,paper, blindfold

Procedure: Child draws a picture while blindfolded. Blindfold is removed. Child draws same picture. Which is better? Why?

C. Materials: Construction paper, color samples from paint folders or shoe makeup folders, colored beads, felt pieces, boxes, The Beginning Science Materials (Holt, Rinehart and Winston Co.)

Procedure: Using the boxes, have each one labeled with a piece of construction paper. Place about one hundred pieces of construction paper, beads, color samples around the room. Children hunt for the items and place them in the correct boxes. If some children are more advanced, shades or tints may be used. When activity is finished, examine the boxes with the children.

D. Materials: Construction paper, various shades and tints of materials in different textures

Procedure: Have the children make collages using various shades and tints in different textures. Some children may enjoy making a booklet of various textures of material.

E. Materials: Ball, eraser, shell, pencil, spool, leaf, rock, etc.

Procedure: Arrange five objects on a tray. Allow the children about thirty seconds to observe the items. Cover the items and give the children a chance to tell what the items were.

3. Leading Question: Can you classify according to size and shape?

A. Materials: Various shapes and sizes of blocks; The Holt, Rinehart and Winston Beginning Science Materials and charts

Procedure: Discuss each item individually. What is meant by the shape of something? Be sure to have the child run his fingers around the rim or edge of each item. Place emphasis on accurate descriptions rather than just naming the shape. Lead them to realize that it is the edge or border that determines the shape. Later a child may be asked to describe a shape verbally without mentioning its name. Others in the group may be called upon to identify the shape.

B. Materials: Items of four basic shapes -- circle (buttons, marbles, bottle caps), square (paper napkin, box tops, blocks), triangle (cut paper, triangle), rectangle (dominoes, paper, blocks); four boxes

Procedure: Encourage the children to choose similar shapes and place them in one of the four small boxes.

4. Leading Question: If you were blindfolded, how would you know what was going on around you?

Materials: Records: "Muffin in the City", "Muffin in the Country"; Record player

Procedure: Introduce the story of Muffin, a dog who had to wear a bandage over his eyes and could not see. Play the record. Discuss the different sounds. This could be the beginning of classifying sounds into:

1. loud sounds and soft sounds
2. pleasant sounds and unpleasant sounds
3. animal sounds and non-animal sounds
4. sounds which convey a message

5. Leading Question: How does sound travel?

A. Materials: Table, stick

Procedure: Tap the table with a stick. What do you hear?

Have the children cover one ear. Repeat the process. What happened? Have the children keep one ear covered and place the other ear on the table. Repeat the process. Is the sound heard better through the air or wood?

B. Materials: Clock, paper bag

Procedure: Listen to the ticking of the clock. Close your eyes. Can you still hear it? Slowly move the clock away from the children. What happens to the sound? Repeat the same process but put the clock in a paper bag. Was there any difference? Why?

6. **Leading Question:** What causes sound?

Materials: Drum, triangle, autoharp or piano, sticks, bells

Procedure: Have the children experiment with various musical instruments. Why are the sounds different? What causes the sound? Lead to the discovery that something vibrates to make the sound. Have the children make different sounds. What happens?

7. **Leading Question:** Can you identify the source of a sound?

A. **Materials:** Tape Recorder

Procedure: Tape various sounds. Let the children identify; for example, school bell, church bells, fire siren, etc. Tape children's voices. See if they can recognize their own voices, their friends' voices.

Turn the volume down very low so it is difficult to hear. What can be done to make it possible to hear?

B. **Materials:** Pictures of animals, pictures of objects that make sounds

Procedure: Children may imitate the sounds made by the animals or objects in the pictures.

Play a game. Child selects a picture without showing it to the class. He imitates the sound and the other children guess.

Children make a classroom chart of objects that make loud sounds, and those that make quiet sounds.

C. **Materials:** Four identical boxes, cotton, metal, china, marbles

Procedure: Place cotton in the bottom on one box, metal in the bottom of another and china in the bottom of another. Leave the fourth box empty. Have each child drop a marble in one of the boxes and tell what he hears. Does each box produce the same sound? Why not? Describe the sound heard.

8. Leading Question: How can different sounds be made?

Materials: Boxes, rubber bands, blocks of wood, sticks, pebbles, small cans, empty bottles, etc.

Procedure: Have the children make instruments and experiment with sounds and sound combinations. Try to bring out with questions the idea that sounds can be made by blowing, striking, rubbing, shaking, etc.

9. Leading Question: Do things that look the same, smell the same? Look different but smell the same? Look the same, but smell different?

A. Materials: Powdered cinnamon, vanilla, salt, flour, tongue depressors

Procedure: Mix the powdered cinnamon with two tablespoons of flour and enough water to give it a paste-like consistency. Mix the salt and two tablespoons of flour and water to give a paste-like consistency. Mix vanilla and water and four tablespoons of flour to make a paste-like consistency. Divide the class into three groups. Give each group a different mixture. Classify the mixtures according to color. Is there another difference between the substances? Warn against tasting an unknown substance. How else can one tell? Lead to the observation that substances that look different may smell different.

B. Materials: Jars with lids, food coloring, white vinegar

Procedure: Show the children two jars, both filled with white vinegar but one colored. Are they the same? Lead to the observation that some things smell the same but look different.

Repeat the same procedure but omit the food coloring. Lead to the observation that some things may look the same and smell the same.

C. Materials: Jars with lids, water, alcohol

Procedure: Show the children two jars, one filled with water and one filled with alcohol. Are they the same? What can one do to find out if they are different? (Warn against tasting a strange substance.) Stress the importance of keeping a safe distance from the jar (lid removed). Child should only be close enough to detect whether there is an odor. Lead to observation that substances may look the same but smell different.

D. Materials: Jars, cotton, perfume

Procedure: Spray perfume on cotton and place in one jar. Put plain cotton in the jar. Do both jars look the same? How else can one tell if they are the same or different?

10. Leading Question: Where is the sense of taste located?

Materials: Sugar

Procedure: Place sugar on different parts of child's body. How can one identify the substance? Lead to observation that tasting is a way of finding out and that one uses his tongue.

11. Leading Question: Can you classify according to taste?

A. Materials: A variety of foods--fruit and vegetables

Procedure: If possible, take the children on a shopping trip. If this is not possible, bring a variety of fruits and vegetables to school and have a tasting party. Discuss color, shape, size, and taste. Include at least one item in each of the following categories--salty, sour, bitter, and sweet.

B. Materials: Cookies, orange juice, cups

Procedure: Give each child a cookie and a small paper cup filled with orange juice. Have the children take a drink of orange juice and then eat the cookie. How does the cookie taste? Have them reverse the procedure by eating a cookie and then drinking the juice. How does the juice taste?

C. Materials: Sugar, water, salt, spoon

Procedure: Dissolve the sugar in water. What do you see? How can one tell it is there? How does it taste? What else could be used for this experiment? Lead to the observation that one cannot see the flavor, it must be tasted.

12. Leading Question: Does the color affect the taste?

Materials: Small paper cups (one for each child), food coloring, water

Procedure: Put water in each cup. Put different food coloring in each cup. Give each child a cup. Each child may identify his color. What does it taste like? Lead to the observation that the color did not affect the taste.

13. Leading Question: How is the body sensitive?

A. Materials: warm water, cold water

Procedure: Have a child place his hand in cold water and then in warm water. Describe the feeling. Reverse the procedure. Describe the feeling. Compare.

B. Materials: Nutcracker, nuts

Procedure: Have the children use the nutcracker to crack nuts. Describe the feeling. (Pressure)

Children may also get the same sensation from shaking hands with each other.

C. Materials: Chair

Procedure: Choose a child to sit with his back to the class. Another child draws a shape on the first child's back. Encourage the child to identify the shape that was drawn on his back.

Instead of shapes numbers can be tapped on their backs.

D. Materials: Mittens

Procedure: Children may go outside during the winter months wearing only one mitten. Why is one hand cold?

14. Leading Question: What does it feel like?

A. Materials: Sandpaper, bags, cotton, rubber, plastic

Procedure: The child feels the sandpaper. Let him hold it in one hand and reach in the bag and find something that feels the same.

The child feels the sandpaper. It is taken away from him. He is given an opportunity to reach in the bag and find something that feels the same.

The child is allowed to look at the sandpaper and asked to find something in the bag that might be the same.

This same procedure may be used with any object.

B. Materials:

Bags, items with a distinctive "feel" such as, cotton, sandpaper, rubber ball, sponge, etc.

Procedure:

Give each child a paper bag in which two or three items have been placed. Children should not be allowed to peek. They may smell and find it doesn't help. This will lead to the sense--feeling. Try to elicit as many terms as possible such as "hard", "soft", "sticky", "rough", "furry", etc.

C. Materials:

Mystery box made of a cardboard box covered with construction paper, The Beginning Science Materials (Holt, Rinehart and Winston Co.)

Procedure:

Cut a hole in the top of the box. Place something in the box. Child who guesses correctly by feeling and describing what is felt, may bring a "surprise" for the box the next day.

HUMAN BODY

GRADE 1

HUMAN BODY

Body Growth and Development

Grade 1

FOREWORD

Note to teacher: In order that this unit be most effective, it is suggested that it be taught in two one-week periods with an interval of 4 months in between.

UNDERSTANDINGS TO BE DISCOVERED	RELATED ACTIVITIES Week #1	Week #2
Living things grow by making more cells	1	
Children grow in an organized pattern but at different rates	2, 3, 4, 5	1, 2
Parts of the body grow and develop at different rates	6, 7, 8, 9, 10	3, 4, 5, 6, 7
Children's bodies change as they grow	11, 12	
Children need food, water, air, rest, and exercise in order to grow	13	

HUMAN BODY

Body Growth and Development

Grade 1

Week #1

ACTIVITIES

1. Leading Question: How do our bodies grow?

A. Materials: Building Blocks

Procedure: Direct a child to build a structure of blocks. Ask the children to note what happens as a block is added.

B. Materials: Microprojector, prepared slide of cell growth, or a teacher made slide of thin onion skin which has been stained with iodine

Procedure: Show the cells to the children with the microprojector. Encourage them to recall what happened as each block was added. Ask the children to interpret what happens to us as new cells (human building blocks) are added.

Think! What happens when you cut yourself?

2. Leading Question: What do you observe about your baby picture? The picture of members of your family?

A. Materials: Baby pictures of each child

Procedure: Let each child show or display his baby picture. Ask the class to interpret what happened to the baby in the picture.

B. Materials: Pictures of the children's families

Procedure: Direct the children to examine the pictures.
Do all children look alike?
Whom do they resemble?
In what ways do children resemble their parents?

3. Leading Question: What do the different sizes of clothing of your family tell about growth and development?

A. Materials: Old baby clothes of the children's

Procedure: Have the children hold their baby clothes against themselves. Encourage the children to interpret how they have changed and grown since they were babies.

B. Materials: Old clothes of the children's mothers and fathers

Procedure: Have the children try on their parents' old clothes. Encourage them to predict how their bodies must grow in order that the clothes might fit.

4. Leading Question: What do pictures of different feet tell about growth?

Materials: Roll of shelf paper, crayons

Procedure: Plan a frieze entitled "Footsteps to Growth". Have the children trace the foot of a younger child, a first grade child, a third grade child, etc. Then an adult. Direct the children to investigate and note the pattern of change.

5. Leading Question: How are you different from other children?

A. Materials: Kraft paper, crayons, scissors

Procedure: Direct the children in making life-size figures of themselves by letting them trace each other on a piece of kraft paper. Then allow the children to color and cut out the tracings of themselves. When all figures are completed, display them. Encourage the children to compare "themselves" with the "other children."

Are all children alike? In what ways are they different?

B. Materials: Tape measure (or string), chart for recording height

Procedure: Measure each child's height and record the measurement on a chart. Encourage the children to examine the chart and to compare their height with their classmates.

C. Materials: Scales, chart for recording weight

Procedure: Weigh each child and record the weight on the class chart. Allow the children to examine the chart and to compare their own weight with their classmates.

6. **Leading Question:** Does your hair change?

A. **Materials:** Calendar or chart for counting days

Procedure: Have a boy who has just had his hair cut tell about his haircut and why he had it cut. Have him count the days until his hair is cut again by marking a calendar or chart.

This discussion of a hair cut could lead into a discussion of other body hair, (eyelashes, eyebrows, etc.) Do eyelashes need to be cut?

B. **Materials:** Camera, film

Procedure:

1. Photograph a boy or girl who is scheduled for a haircut. Photograph the child again after the haircut. Compare and discuss the differences in the photographs.
2. Photograph several children (some with short hair and some with long hair). Discuss the differences in the length of hair of these children. Why do some children have short hair and some have long hair?

C. **Materials:** Scissors

Procedure: Invite a barber or beautician to visit the class and explain his or her job. If possible have him or her cut the hair of a child whose parents have given permission for the haircut. Ask the class to anticipate what will happen to the child's hair.

7. **Leading Question:** Do teeth change as you grow older?

A. **Materials:** Mirror

Procedure: Have the children look in a mirror and count their baby teeth. Discuss the findings. How many baby teeth do you have? Are any of your baby teeth loose? What will happen to the loose baby teeth? Have any of your baby teeth been pulled? Do you have any permanent (second) teeth? Tell how you take care of your teeth?

B. Materials: Salt clay (made of salt and cocoa starch)

Procedure: Have children of different ages and an adult make impressions of their teeth in a piece of salt clay. After the salt clay pieces have hardened, arrange in order of age of person and label each impression; (i.e. 4 year old child, 6 year old child, etc.) After examination of the impressions encourage the children to determine and describe the differences. What changes take place as a child grows?

C. Materials: Model of teeth (available from science center)

Procedure: Have the children take turns telling about the teeth in the model. How did they start? What happened to the baby teeth?

8. Leading Question: Do fingernails change?

Materials: Nail polish

Procedure: Let the children or a child, or the teacher, paint a line at the base and the tip of a fingernail. Have the children examine the lines every day and tell what happens.

9. Leading Question: Do bones change as you grow older?

A. Materials: Calipers (available at the Central Science Materials Center) or strings of different colors for each child to be measured

Procedure: Select three or more children of varying ages, (first grader, second grader, fourth grader, etc.) Inform the class that the children's arms will be measured from the elbow to the wrist.

Divide the class into groups (one group for each child to be measured). Allow each group to measure the children's arms and record the measurements made.

Before the measurements are reported ask the class to anticipate the results.

Whose arm is longer? Whose arm is shorter? Why?

This activity may lead into measuring of other parts of the body such as the head, the wrist, etc.

B. Materials: X-rays of the bones of children and adults which have been obtained from a doctor or pictures of x-rays from a book

Procedure: Display the x-rays. (Use an opague projector if using a book with pictures.) Have the class identify those taken of children and those of adults.

What are the differences that can be seen in the x-ray pictures? Encourage the children to interpret how the bones change as children grow.

10. Leading Question: Do your muscles grow?

Materials: Tumbling mat, shorts or slacks for girls

Procedure: Place the mat on the floor. Have the children work in pairs as they perform air sit-ups.

Starting Position:

1. The child lies on his back, hands clasped behind his neck, knees bent, feet flat on floor with partner holding ankles.

2. The child attempts to raise trunk to a 90° angle with floor and returns to starting position.

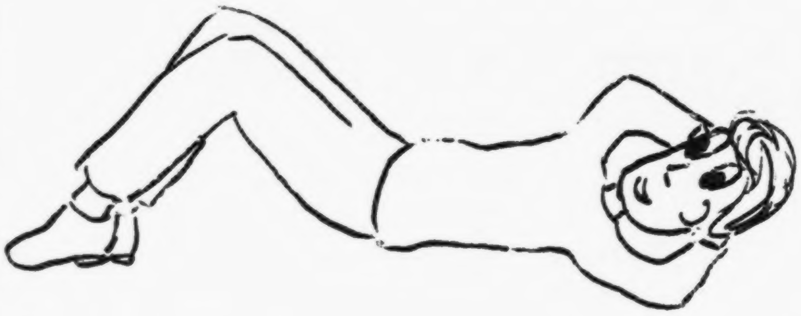
3. Count the number of times the child successfully performs the exercise.

4. Keep a record of a child's performance over the one week period or longer.

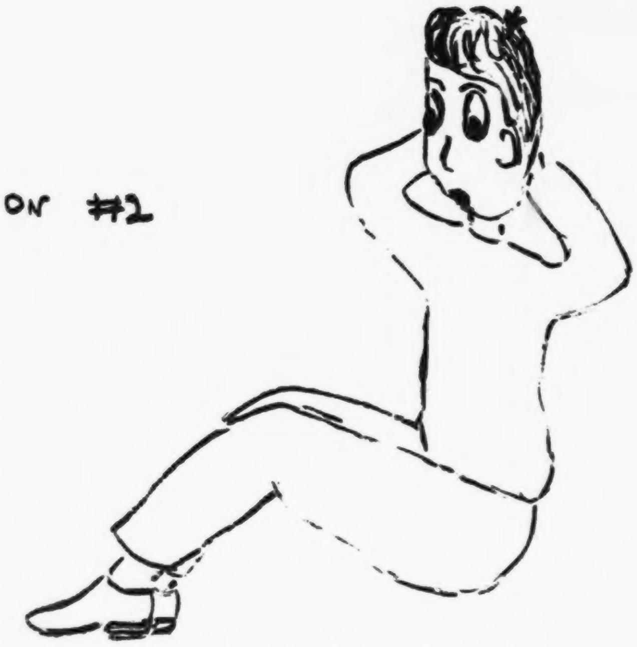
5. Have the children discuss any progress. Could they do better? Why? How would our bodies grow without exercise?

CAUTION: Do not allow a child to exceed five times.

POSITION #1



POSITION #2



11. Leading Question: Will exercise help to improve your muscles?

A. Materials: Jump ropes, chart for recording the number of jumps

Procedure: Let each child have a chance to jump with a rope. Record the number of successful jumps made each day during a one week period. At the end of the week let each child compare his daily scores.

Is there any difference in the scores? When was there a difference? Why?

B. Materials: Rubber balls

Procedure: Following the same procedure in activity A let each child bounce a ball. Then keep a daily record of the number of bounces. At the end of one week let each child compare his daily scores.

Are there any differences in the scores? When did the difference occur? Why?

C. Materials: Pictures to color, crayons

Procedure: Give each child a picture to color. When they are completed collect them and put them in a folder to save for comparison with the same picture colored in week two of this unit.

12. Leading Question: In what ways do persons change in behavior as they grow older?

Materials: Puppets

Procedure: Have the children dramatize certain situations playing the role of a baby, then the role of a first grader and possibly the role of an older child, and the role of their parents.

Example: How would a baby act if he were hungry? How would a first grader act if he were hungry? How does mother act if she is hungry?

After the dramatizations encourage the children to discuss the differences in behavior. In what ways do children change as they grow?

13. Leading Question: What are the main necessities for body growth?

Materials: Soil, three plants (coleus plants would be good), and two planting pots

A. Procedure: Display the plants. Have the children decide how they would care for a plant. Tell the children that only two plants will be potted and only one plant will be cared for. Have the children decide where to place the three plants when the two plants have been potted.

Choose children each day to care for the one plant. Then encourage all of the children to examine each plant each day.

After a few days discuss the differences the children discovered in the three plants. Have the children determine why one plant grew and why the others did not. Then encourage the children to infer what they will need to make their bodies grow. (food and water)

B. Procedure: Have the children close their mouths and hold their noses until one child stops. Then ask the child why he stopped? What did your body need? (air) Do you think our bodies would grow without air?

C. Procedure: Have the children run in place until one child stops. Ask the child why he stopped. What did your body need? (rest) Do you think our bodies need rest to grow?

D. Procedure: Have the children grasp and tightly hold a chair or table leg until one child stops. Ask the child why he stopped. What did your body need? (exercise) Why do our bodies need exercise?

Body Growth and Development — Grade 1

Week #2

ACTIVITIES

1. Leading Question: How is your body different than it was four months ago?

   Procedure: Repeat activities 5A, 5B, and 5C of week #1. Compare and discuss the differences in the findings of week #1 and the findings of week #2, (1) for each child and (2) for the class.

2. Leading Question: In what ways have you changed in four months?

   Materials: Charts with records of two or more height and weight measurements for each child.

   Procedure: Display the charts. Lead each child to compare his own two height and weight measurements. Encourage them to determine what the differences mean.

3. Leading Question: Has your hair changed in a period of four months?

   Materials: Camera, film

   Procedure: Repeat Activity 6B, part 2. Compare the two photographs of each child. Have the class note and describe any changes in the length of hair.

4. Leading Question: Have your teeth changed in a period of four months?

   A. Materials: Paper to make booklets, crayons

   Procedure: Invite a dental hygienist or dentist to visit the class. Encourage the child to ask questions about the growth of teeth.

   After the visit review the information gathered. Then direct the children in putting this information into a booklet.

   B. Materials: Shelf paper, cardboard box, wooden dowels, crayons

   Procedure: Have the children search for information on how their teeth grow by observing the teeth of people of all ages by asking their friends and family or their dentist about the growth of teeth, and by looking in books about teeth. Lead the children in a discussion of their findings. Then have them decide how their findings should be recorded on the roll of shelf paper. When the drawings are finished, fasten the roll to the dowels and then put in the box which has been designed as a television set.

5. Leading Question: Has daily exercise changed your body over a period of four months?

Procedure: Repeat Activity #10 in week #1.

Have the class compare and discuss any differences in the recorded performance of week one and week two.

6. Leading Question: Did daily exercise change your muscles over a period of four months?

Procedure: Repeat Activity 11A, 11B, and 11C.

Compare the charts from week #1 with those of week #2. Also compare the pictures colored in week #1 and those colored in week #2. Are there any differences? Why?

7. Leading Question: Do all parts of your body grow at the same rate?

Materials: Transparencies and or charts of the human body (the skeleton, the muscles and the teeth)

Procedure: Use the transparencies or charts to review interests and discussions on the growth of the human body. Encourage the children to compare rates of growth of different parts of their bodies.

Example: Do teeth seem to grow as fast as our hair? Do we need to cut all the hair that grows on our bodies? Why? Which seems to grow faster--your fingers or your fingernails? How do you know?

HUMAN BODY

GRADE 2

The Senses and Their Function

Grade 2

UNDERSTANDINGS TO BE DISCOVERED	RELATED ACTIVITIES
We find out about things by seeing, hearing, tasting, smelling and touching.	
Seeing occurs by light which brings sizes, shapes, numbers, and colors to our eyes.	2, 3, 5, 6
Light travels in a straight line.	4, 7, 8, 9, 10, 11, 12, 14
Light travels through some objects.	8, 9, 10, 11, 12, 14
Light is reflected from some objects.	3, 4, 7, 8, 9, 10, 11, 13, 14
When light rays are scattered, color can be seen.	5, 6, 8, 9, 10, 11, 14, 15
Hearing occurs when our ears collect sound waves.	16, 17, 18, 19, 20, 21, 22, 23, 24, 25
Sound occurs when something vibrates.	16, 17, 18, 19, 20, 21, 22, 23, 24, 25
Smelling occurs when the nose becomes sensitive to odor.	26, 27, 28, 29, 30, 31
Smells can be pleasant or unpleasant.	26, 27, 28, 29, 30, 31
Tasting occurs when the papillae on the tongue reacts to flavors.	32, 33, 34, 35
Tastes are primarily salty, sweet, sour and bitter.	32, 33, 34, 35
Taste and smell rely on chemicals in the food.	33, 34, 35, 37, 38
Feeling occurs when the skin and muscles react to external stimuli.	39, 40, 41

UNDERSTANDINGS TO BE DISCOVERED (Cont'd)	RELATED ACTIVITIES
Various senses operate automatically in the body.	42, 43, 44, 45
Similarities and differences in objects must be discovered and grouped by the brain.	42, 43, 44, 45
The brain depends on the senses for knowledge of the external world.	42, 43, 44, 45
Messages from the brain and senses give pleasure or warning.	43, 45

The Senses and Their Functions

Grade 2

ACTIVITIES

1. Leading Question: How do you know?

A. Materials: Small objects

Procedure: Let a child select one small object and hide it behind his back. The class is permitted to ask questions in identifying the object. The winning guesser is then given a turn at choosing an object.

B. Materials: Film "Santa's Workshop"

Procedure: Show this silent colored film to the class. Let the children describe what they saw. Act out the film. How will the children know what to do or use to act it out?

C. Materials: Picture of a family on a picnic in the park

Procedure: Display the picture where everyone can see it. Ask the children to describe what is taking place. Classify what you smell, hear, feel or see in the picture.

2. Leading Question: How is drawing made easier?

Materials: Crayon, paper

Procedure: Have children close their eyes. A sheet of drawing paper and crayons should be ready on every desk. Instruct children to draw a box, a man and an apple. The children should draw with their eyes closed. On another sheet of paper allow them to draw the same pictures with their eyes open. Compare the pictures. How do our eyes help?

3. Leading Question: Does light affect your eyes?

A. Materials: Mirror, light

Procedure: Instruct the children to look at their eyes in a mirror. No light should be on. Now darken the room by pulling down the shades. Wait about five minutes. Ask the children to look in the mirror at their eyes. Next pull the shades up an turn on the light. Ask the children to look in the mirror and watch what happens? How does light affect a person's eyes?

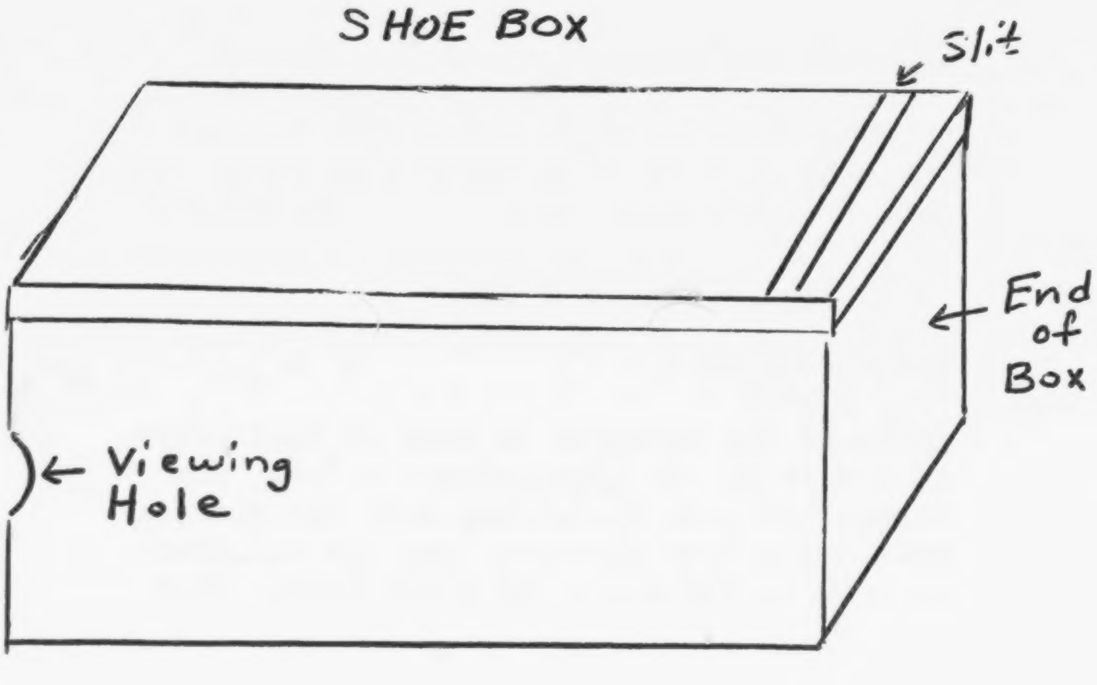
B. **Materials:** Scissors, black paper, rubber band

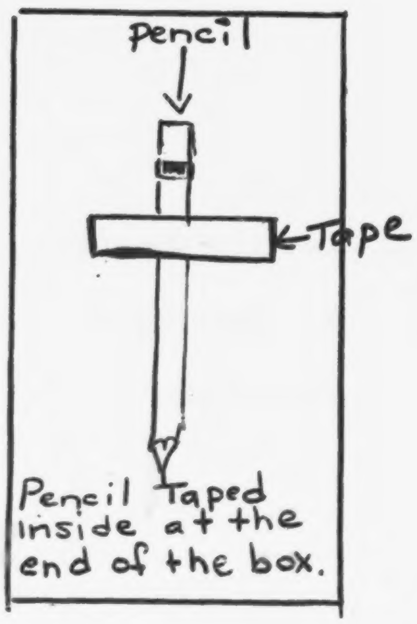
Procedure: Instruct the children to cut a mask from black construction paper. Make a slit in the eye holes 1/8 inch wide and one inch long. Let them fasten a rubber band like an elastic headband. Go outside on a snowy, sunny day with the mask on. Instruct the children to take the mask off. What is the difference? How do they feel? Why? Why do skiers wear sunglasses?

4. **Leading Question:** How does a camera work?

Materials: Shoe box with a hole at one end, pencil, tape, flashlight

Procedure: Let a child tape a pencil to the inside, far end of a shoe box. Place the cover on the box. Let the class take turns looking through the hole. What is seen? Now let the child cut a hole in the lid of the box over the pencil. The slit should be $\frac{1}{4}$ inch wide across the width of the lid. Use the flashlight pointed through the slit towards the pencil. Once again let the class look in the hole. Is there any difference? Why? How does this box remind you of a camera? How is it different from a camera? Discuss.





5. Leading Question: Describe what is missing?

Materials: Colored blocks, blindfold

Procedure: Place five colored blocks on the table. Let the children look at them and then close their eyes. Remove one block and rearrange the others. Which block is missing? How do you know? Objects may be used instead of blocks.

6. Leading Question: Is light important?

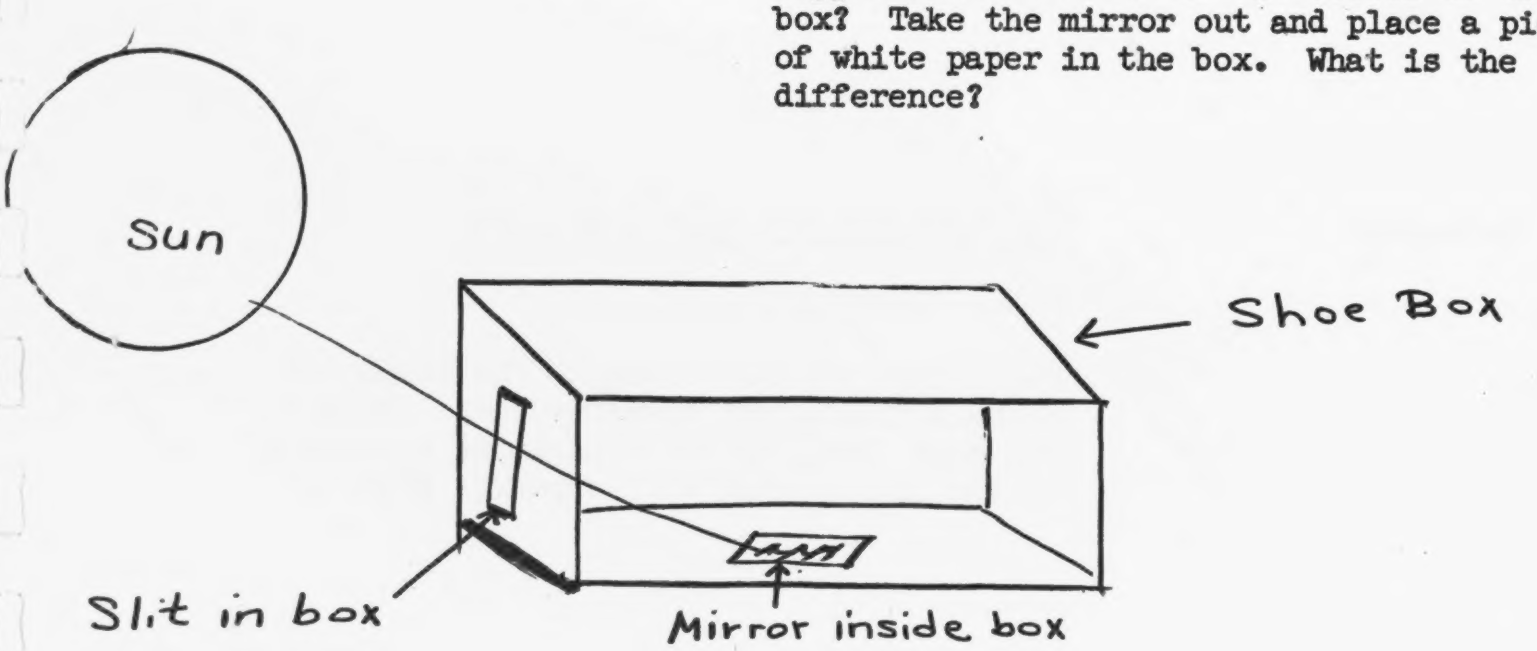
Materials: Object in classroom

Procedure: Darken a room by pulling the shades and turning off the light. Ask what can be seen. Add light for a few moments. Question the children in regard to what they saw in those few moments. The third time increase the intensity of light and the length of time. Ask what was seen this time? Allow the children to draw conclusions in relationship to the number of objects seen in comparison to the viewing time. Which colors were more prominent?

7. Leading Question: How does light travel?

Materials: Shoe box, black paint, scissors

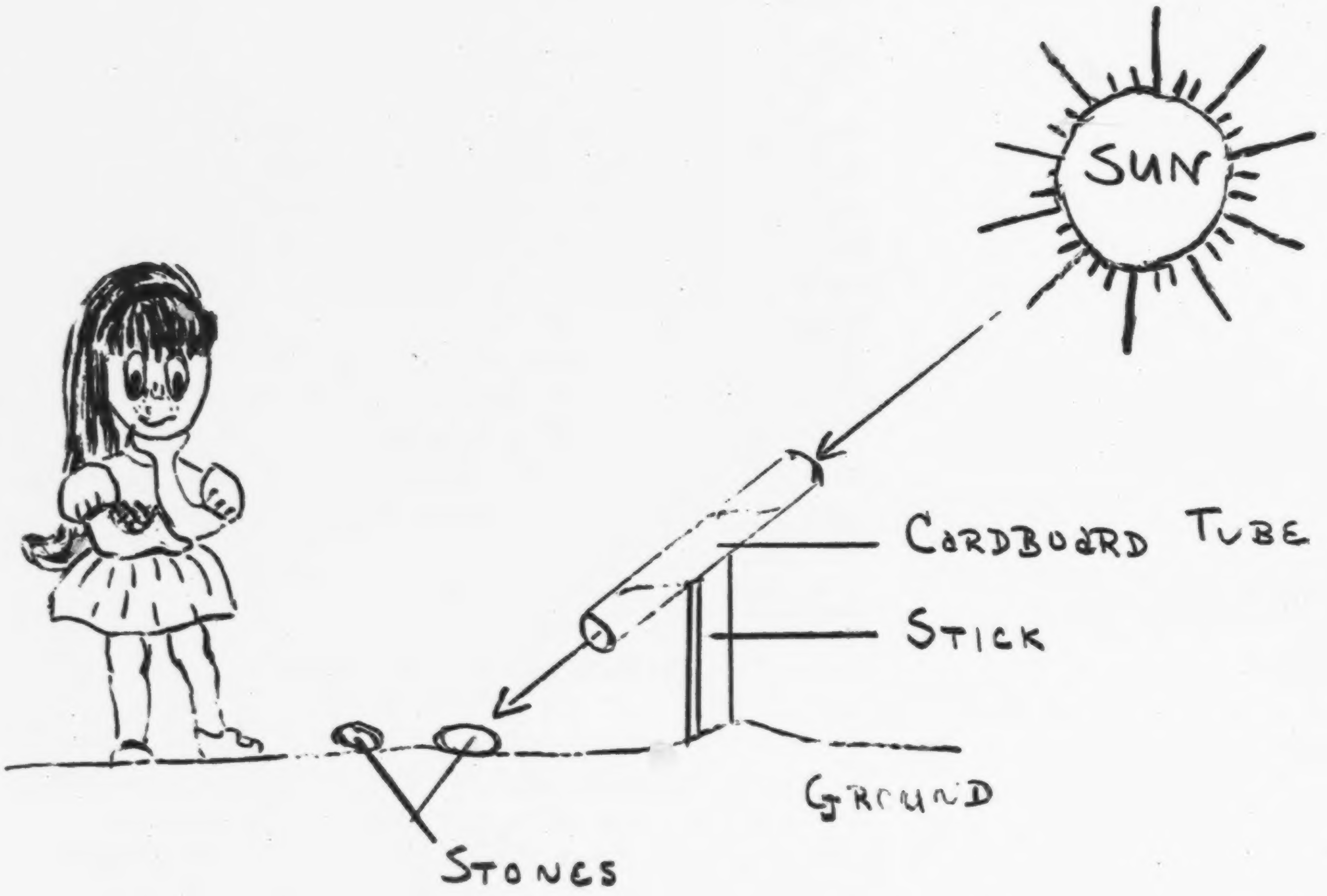
Procedure: Paint the inside of a shoe box black. Cut a one inch slit across the side. Place the box in the sun with the slit end facing the light. From where did the light come? Where does the light travel? What would happen with a mirror in the bottom of the box? Take the mirror out and place a piece of white paper in the box. What is the difference?



8. Leading Question: How does light cast shadows?

Materials: Stick, cardboard tube, stone, chalk

Procedure: Place a stick in the ground. Nail a cardboard tube on top of the stick. Point the tube toward the sun. Look for the bright spot in the shadow of the tube. Place a stone on that spot. This should be done every hour, all day long. Ask the children what this experiment should demonstrate?

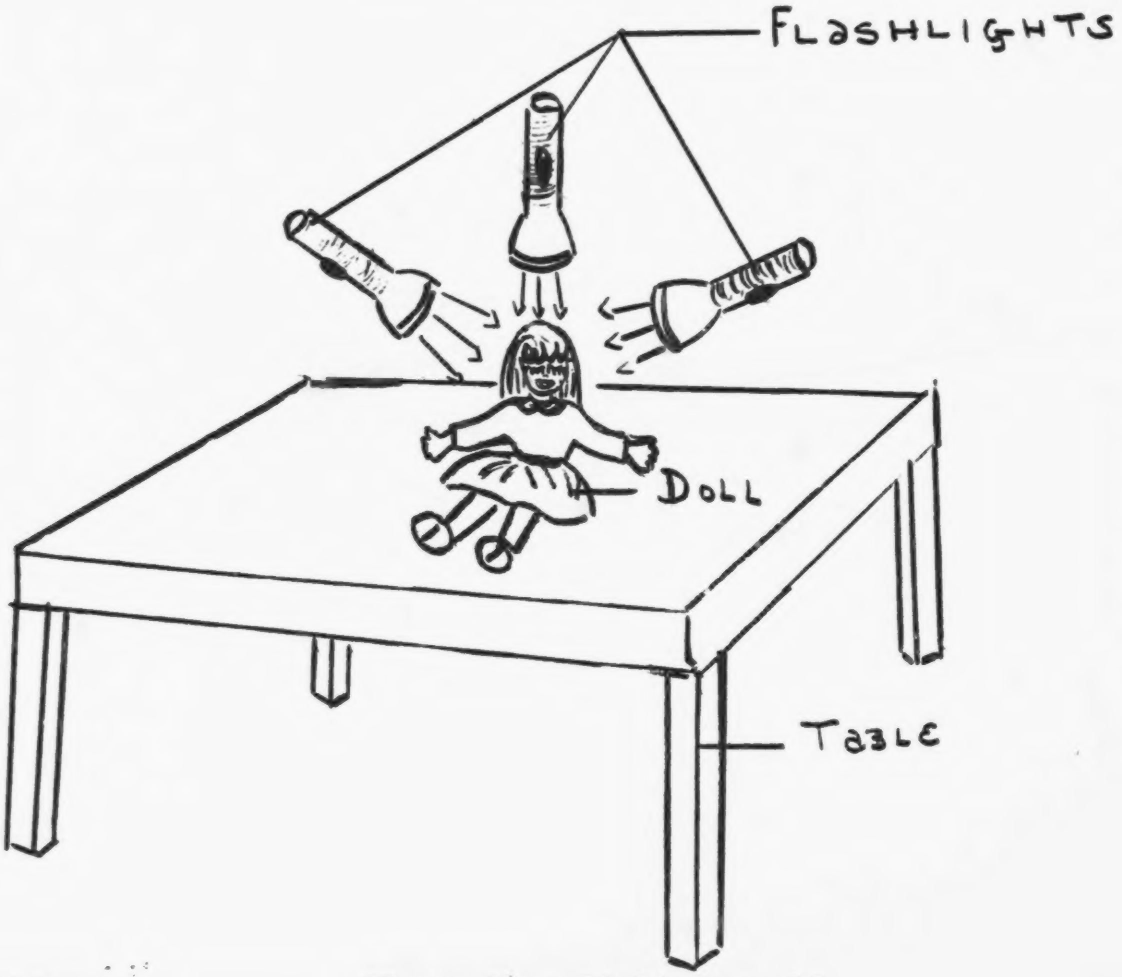


9. Leading Question: How does the sun affect shadows?

Materials: Doll, flashlight

Procedure: Put a doll in the center of the table and shine a flashlight down over her. What do you see? Now, if you change the direction of the light, what will appear? Why?

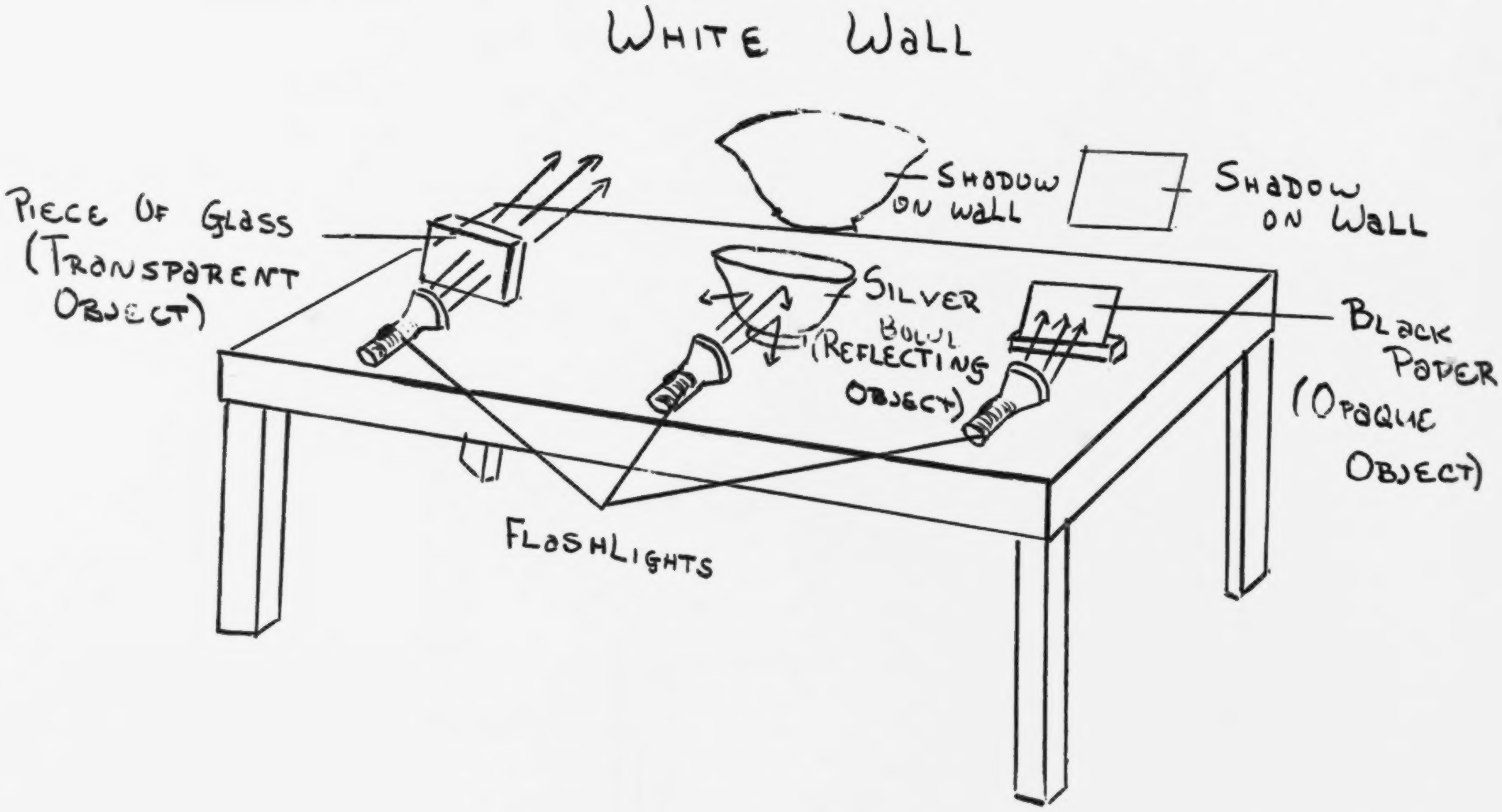
Lead to the observation that light must travel in a straight line. The shadow was a straight line from the source of light.



10. Leading Question: Where does light travel?

A. Materials: Flashlight, transparent objects, opaque objects, shiny objects, white wall

Procedure: Place transparent, opaque, and reflecting objects on a table in front of a white wall. Place a light in front of the objects so their shadow will appear on the white wall. What noticable difference do you see? Classify the objects according to their different properties. (transparencies, opaque objects, reflecting objects)


WHITE WALL
PIECE OF GLASS (TRANSPARENT OBJECT)
SHADOW ON WALL
SHADOW ON WALL
SILVER BOWL (REFLECTING OBJECT)
BLACK PAPER (OPAQUE OBJECT)
FLASHLIGHTS

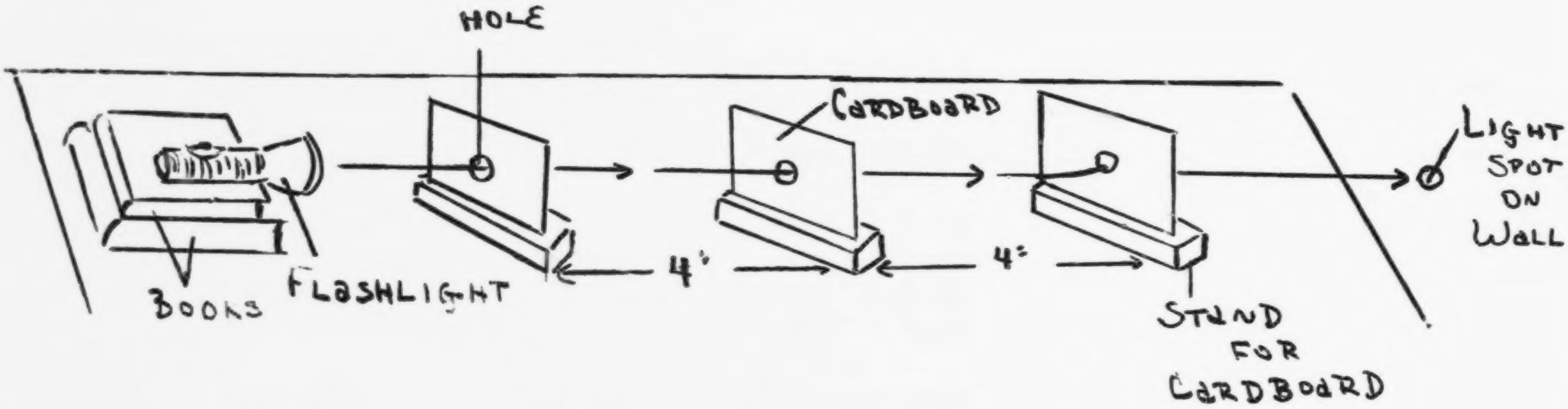
B. Materials:

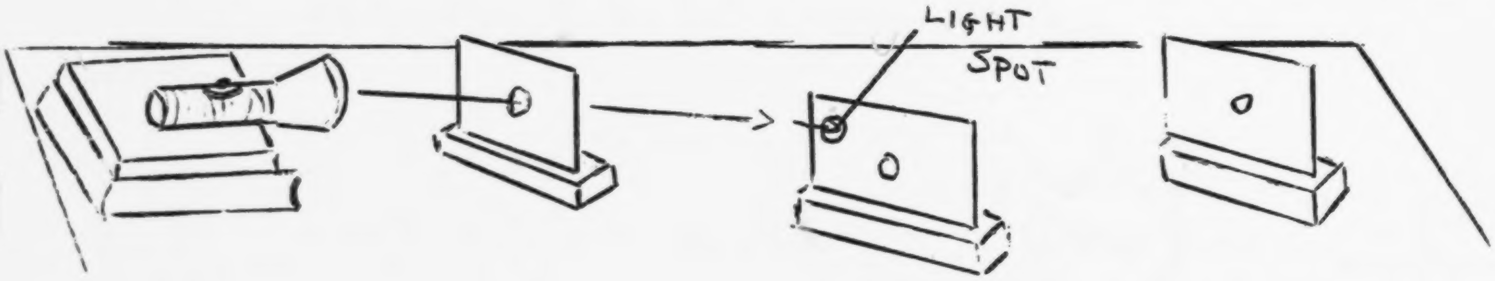
Flashlight, three pieces of cardboard with holes in the center at the same level, clay mounds to prop the cardboard

Procedure:

Measure carefully and place three pieces of cardboard with holes the same distance apart (4 inches). The holes should be directly in line with one another. Place the flashlight at the same level as the holes, so the light will be able to shine through them.

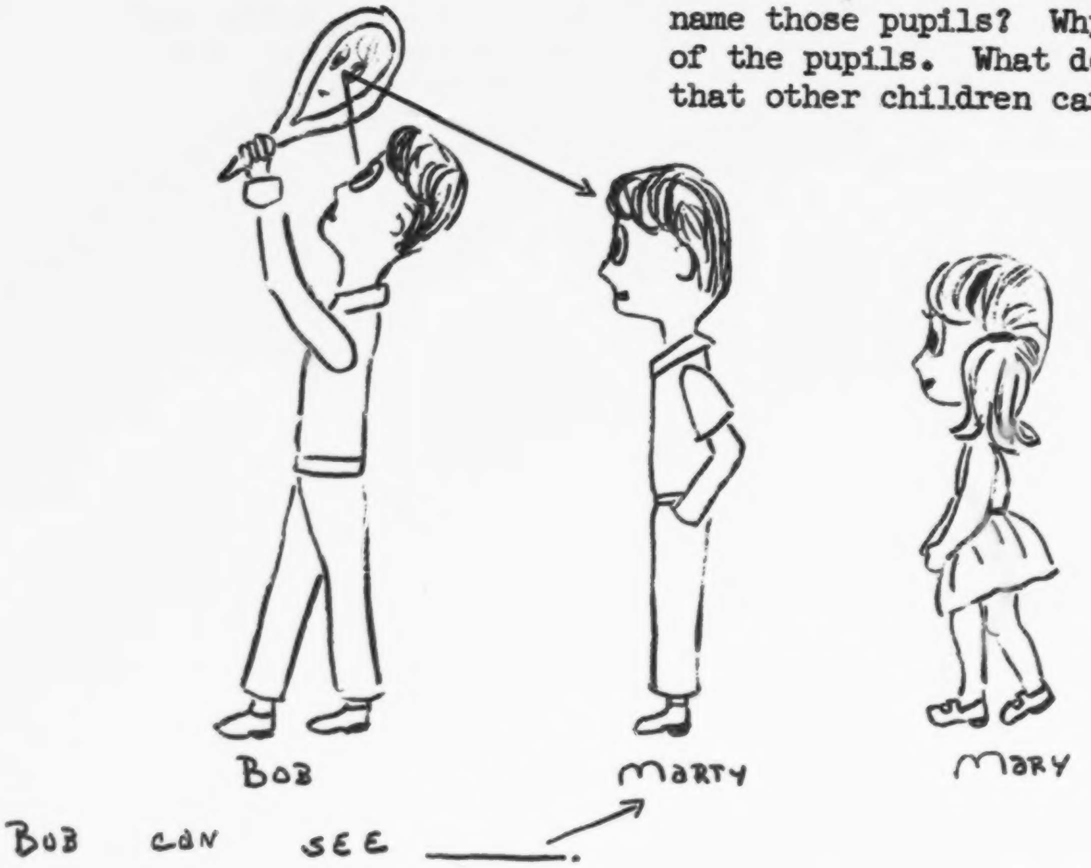
Move one cardboard an inch to the right. Look through and report what you see. Inform children that the other pieces may be moved in the same way.


HOLE
CARDBOARD
LIGHT SPOT ON WALL
BOOKS
FLASHLIGHT
4'
4'
STAND FOR CARDBOARD



C. Materials: Mirror

Procedure: Instruct a child to hold a mirror up so that he can see it. He should turn his back to the class. By looking in a mirror he should be able to name which pupils can see his eyes in the mirror. Why can he name those pupils? Why can't he name all of the pupils. What does he need to do so that other children can see his eyes?

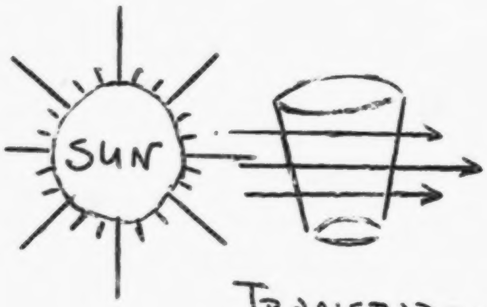

BOB
MARTY
MARY
BOB CAN SEE ______.

11. Leading Question: Does light travel through all media?

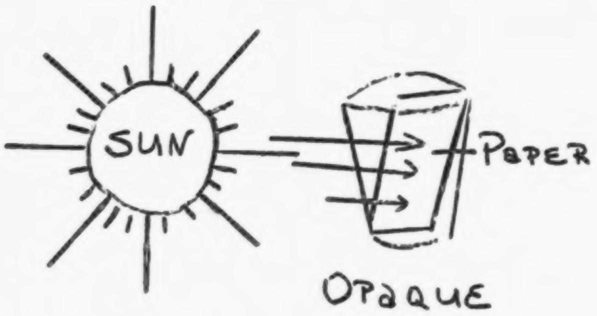
Materials: Glass, paper, mirror

Procedure: Hold a drinking glass up to the light. What do you see? Place a piece of paper in the glass. Now look through. What happened? Why?

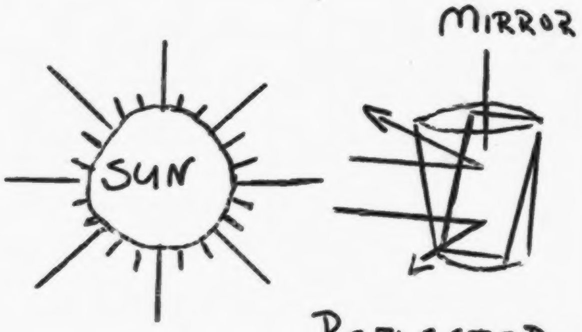
Take the paper out and put a mirror in the glass? Observe what happens now. Why?



TRANSPARENT



OPAQUE

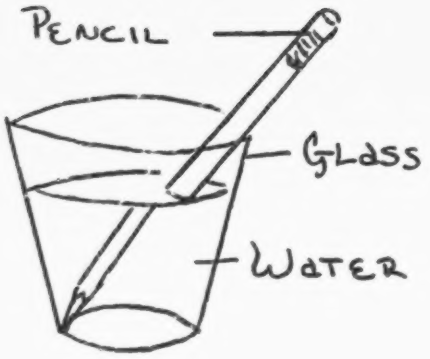


REFLECTED

12. Leading Question: Does water bend a pencil?

Materials: Pencil, glass of water, milk, card with slit in it, flashlight.

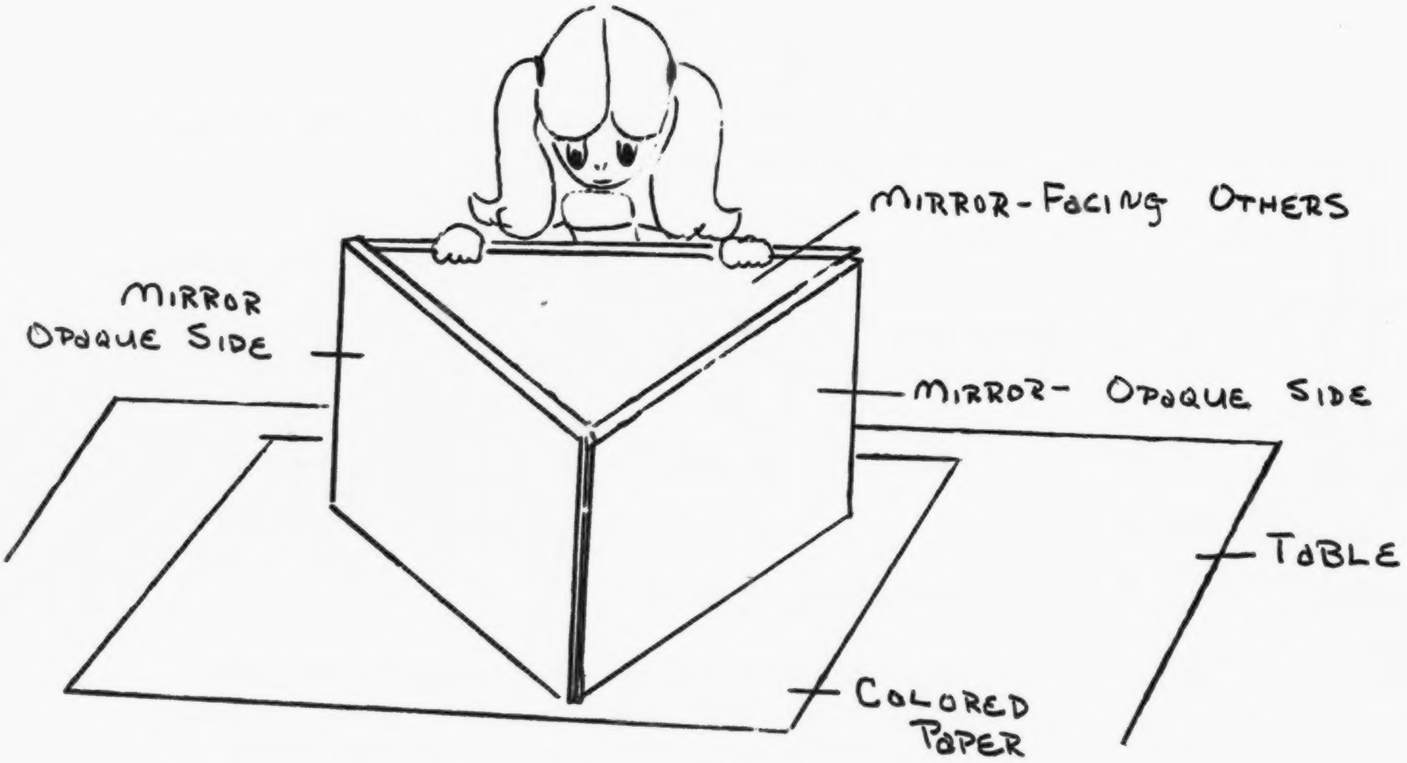
Procedure: Look at the pencil. Place it in a glass half filled with water. Look at the pencil from all angles. What is the difference.



13. Leading Question: Does light bounce from mirrors?

Materials: Three mirrors, tape, colored picture

Procedure: Place three mirrors together to form a triangle. Stand the triangle on a piece of colored paper. The children should look into the center of the triangle and discover what happened. What causes this? What toy is made like this?

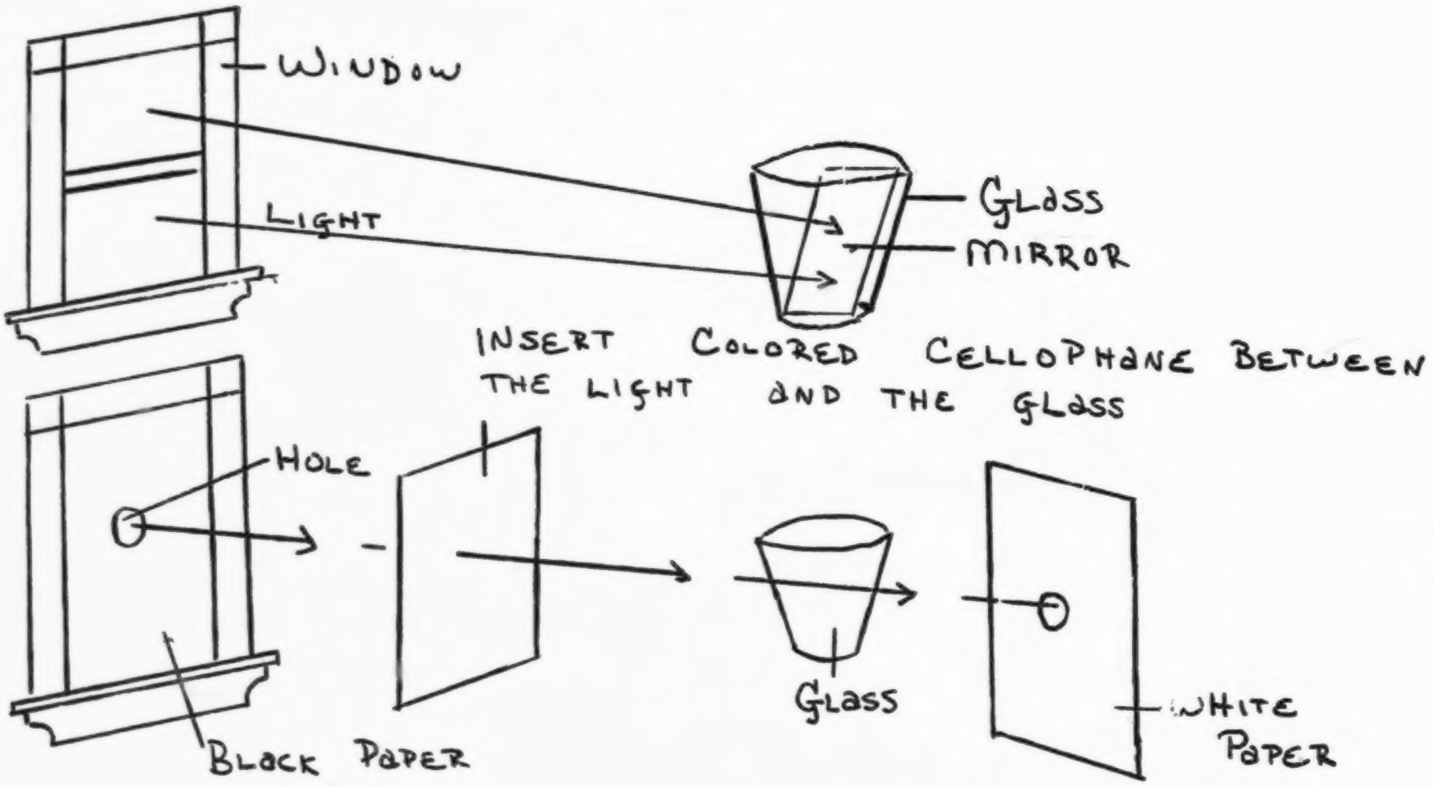


14. Leading Question: What is color?

A. Materials: Glass of water, mirror, white paper, cellophane

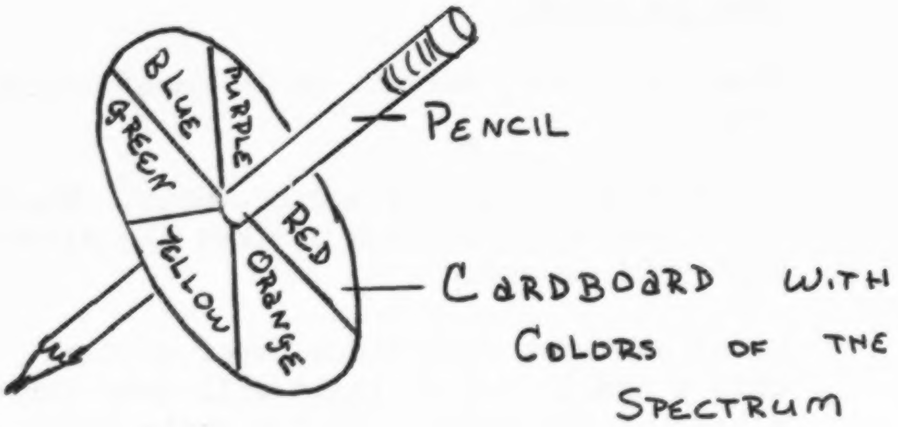
Procedure: Place a mirror in a glass of water. Slant the glass until the sun strikes the mirror. What will be seen?

Cover a window with black paper so that only a small beam of light will come through a hole in the paper. Hold a white sheet of paper behind the glass so it picks up the light coming from the window. Notice how it looks! Now insert different colors of cellophane paper between the light and the glass. What is the difference on the white paper?


WINDOW
LIGHT
GLASS
MIRROR
INSERT COLORED CELLOPHANE BETWEEN THE LIGHT AND THE GLASS
HOLE
GLASS
WHITE PAPER
BLACK PAPER

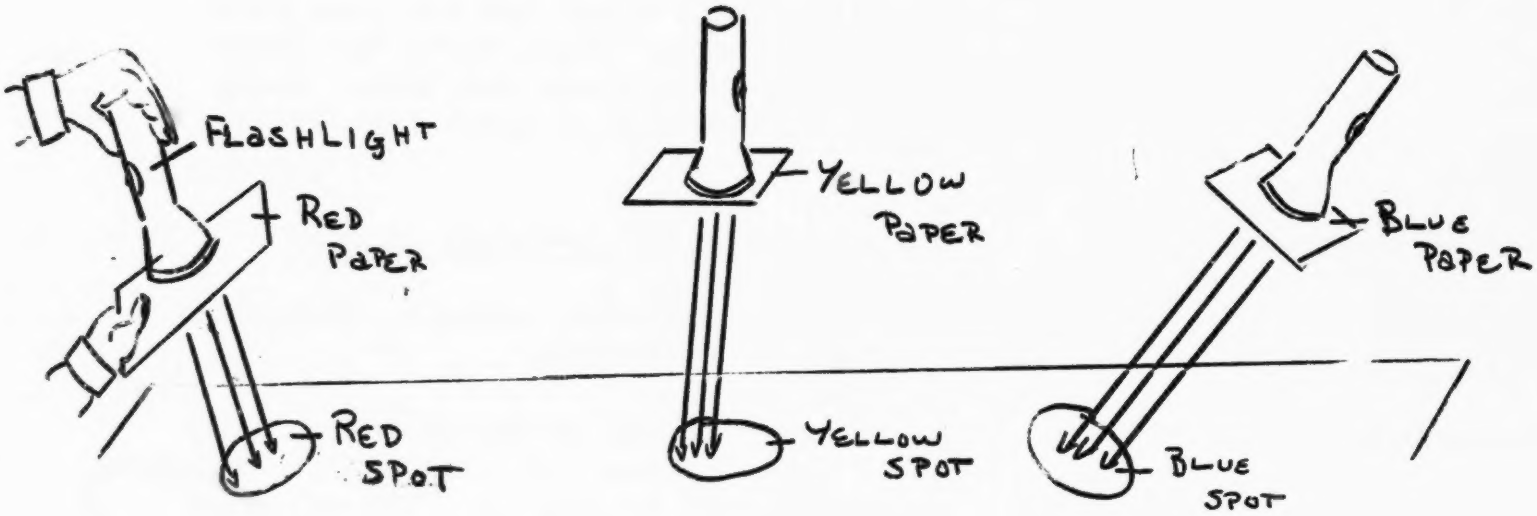
B. Materials: Cardboard, pencil

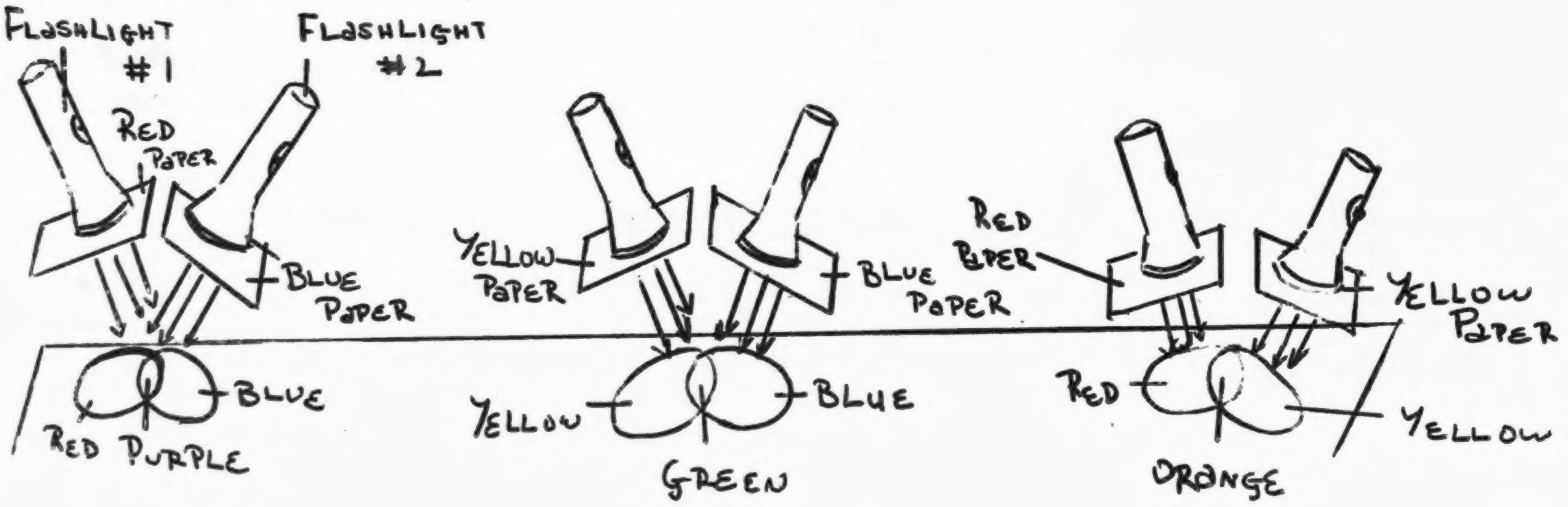
Procedure: The children should cut a cardboard and divide it into six equal sections. Paint each section according to the spectrum, (red, orange, yellow, green, blue, purple). Place a pencil through the center and spin. What happens to the color?


BLUE
PURPLE
GREEN
RED
YELLOW
ORANGE
PENCIL
CARDBOARD WITH COLORS OF THE SPECTRUM

C. Materials: Three flashlights, 4" squares of very thin red, blue and yellow paper

Procedure: Have the children shine the flashlight on the floor of a dark room. Place a different color square on each flashlight. Let the children combine the colored circles of light on the floor. What do they see?


FLASHLIGHT
RED PAPER
RED SPOT
YELLOW PAPER
YELLOW SPOT
BLUE PAPER
BLUE SPOT


FLASHLIGHT #1
FLASHLIGHT #2
RED PAPER
BLUE PAPER
BLUE
RED PURPLE
YELLOW PAPER
BLUE PAPER
YELLOW
BLUE
GREEN
RED PAPER
YELLOW PAPER
RED
YELLOW
ORANGE

15. **Leading Question:** Do soap bubbles have color in them?

Materials: Soap bubbles

Procedure: On a sunny day blow some bubbles in the classroom. What will the children notice?

16. Leading Question: What do you hear?

Materials: Empty room

Procedure: Permit a child to enter an empty room and make a noise. What happens in the room? Why?

17. Leading Question: How do you hear?

Materials: None

Procedure: Choose a student to sit with his eyes closed and his back to the class. Someone should stand directly behind him and clap first behind his neck. Guess where the sound came from? Clap above his head. Guess again. Is it easy to guess from where a sound comes?

18. Leading Question: Can you recognize different sounds?

Materials: Sand blocks, maracas, cymbals, tamborine, triangle, sticks, drum

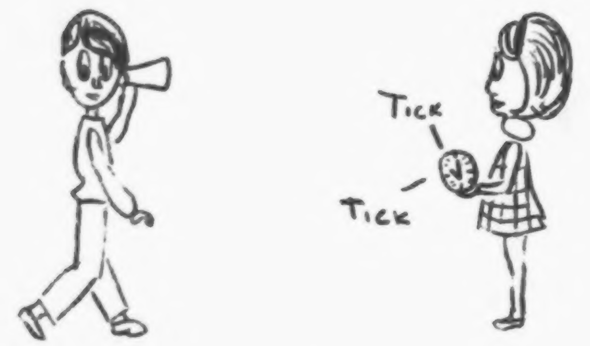
Procedure: Allow the children in the class to close their eyes. Choose one child to choose an instrument and to play it. The children should raise their hands when they recognize the sound. The child who is "it" chooses one of the children to answer. If the answer is correct, the winner chooses another instrument and the game proceeds in the same way.

19. Leading Question: Is distance important in hearing?

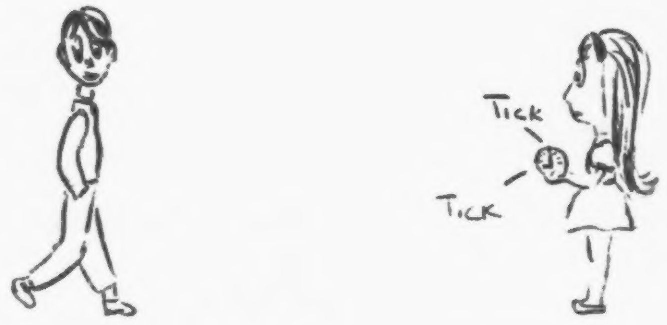
Materials: Sheet of paper, alarm clock

Procedure: Curl and tape a sheet of paper like a horn. Give it to someone standing at one end of the room. Have another child stand at the other end of the room with a clock. With the horn to his ear, the student should walk toward the ticking clock. Mark the place where he first hears the ticking.

Now do the same thing without the horn. What will be the difference?



WITH HORN



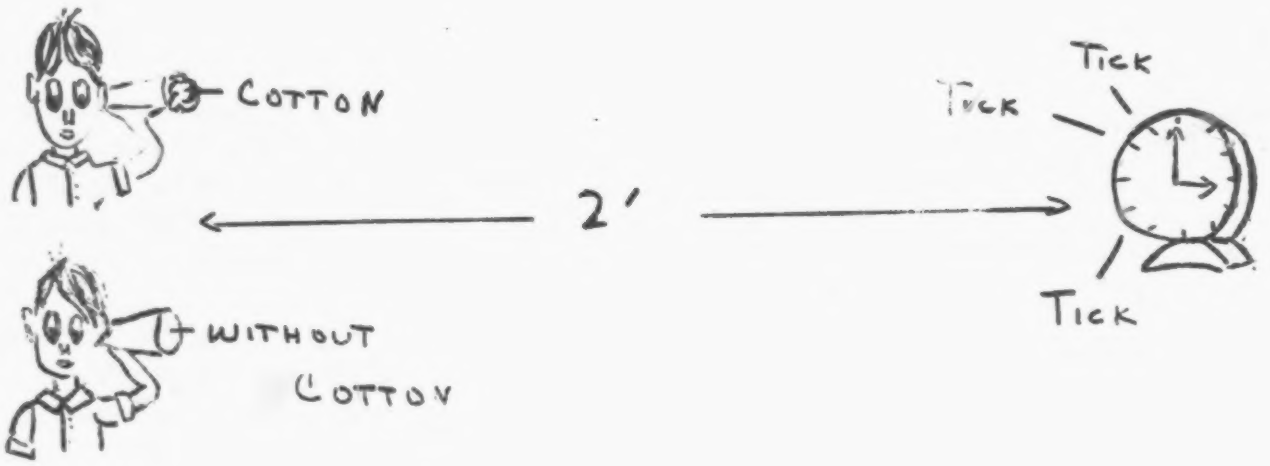
WITHOUT HORN

20. Leading Question: Are sounds loud or soft?

Materials: Two sheets of paper, cotton, tape, clock

Procedure: Shape the papers into cylinders and tape. Place cotton in one cylinder. Place this one near the ear and stand two feet from a ticking clock. What do you hear?

Do the same with the other cylinder. Is there a difference? Why?

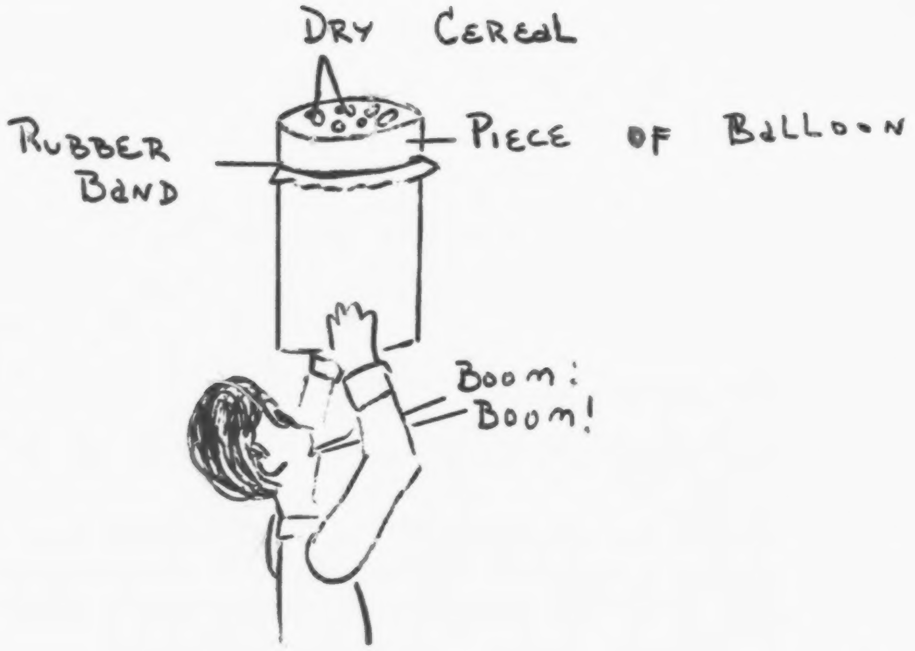


21. Leading Question: What makes sound?

Materials: Tin can, can opener, rubber balloon, rubber band, dry cereal

Procedure: Remove both ends of a tin can. Permit a student to stretch a piece of a rubber balloon across one end of the can. Fasten it with a rubber band. Let another child place dry cereal on the rubber on the end of the can.

Select a third child to hold the can and shout "Boom Boom" into the open end. What happens to the cereal on top? Why?



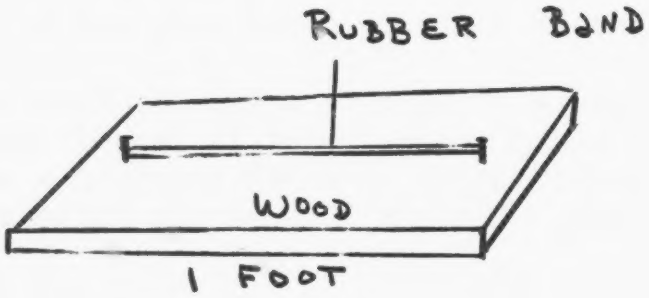
22. Leading Question: How does a violin make sound?

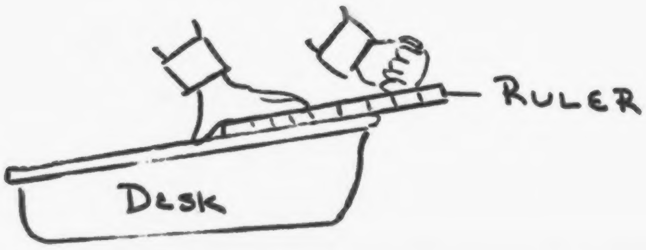
Materials: A board, two nails, rubber band, ruler

Procedure: Instruct a child to hammer a nail in each end of a one foot board. Next, he is to stretch a rubber band from one nail to the other. Strum the rubber band. What is heard? What is seen?

Permit the children of the class to extend their rulers from the edge of the desk. They should be held securely at the end of the desks. Strike the extended ends of the rulers with the other hand. What happens to the rulers?

Compare the ruler to the board. Are they the same or different? What happens to each?


RUBBER BAND
WOOD
1 FOOT

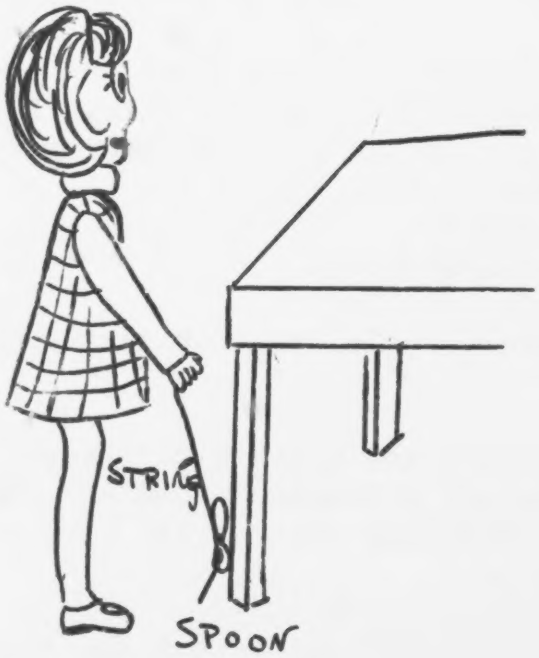


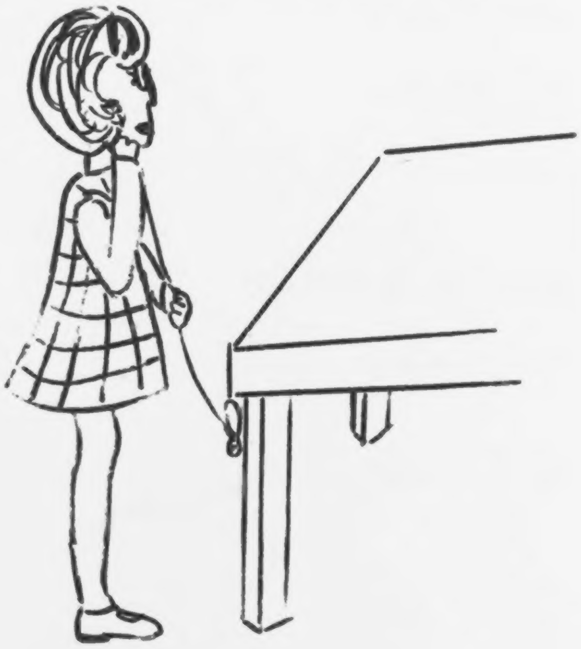
23. Leading Question: What organ of the body catches sound?

Materials: String, spoon

Procedure: Tie a spoon at the end of a two foot string. Hold the string while the spoon is struck against the leg of a table.

Wind the string around one finger and hold this hand against the ear. Strike the spoon against the table. What is the difference?


STRING
SPOON

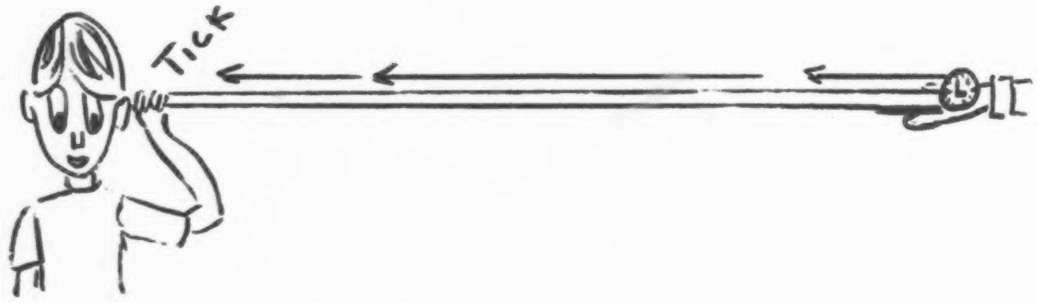


24. Leading Question: How does sound travel farther?

Materials: Six foot stick or metal rod, watch

Procedure: Choose a student to stand six feet away from a ticking watch. What is heard? Place a six foot stick or metal rod from a watch to an ear. Let him observe the difference.

TICK
TICK
TICK



Note to teacher: This experiment can also be effective at other distances.

25. Leading Question: How does sound travel?

Materials: Pencil, paper, recordings of different sounds

Procedure: Listen to different sounds. Children should close eyes and listen a second time. Lines should be drawn on the paper according to the sounds they hear.

26. Leading Question: How does your nose help?

Materials: A slice of pear, apple, potato, clothespin, a blindfold

Procedure: Blindfold a child and place a clothespin on his nose. Select a prepared food and let him eat it. Identify what it is. Try other foods.

Remove the clothespin and repeat the experiment. Record the results.

27. Leading Question: Who are the better detectives?

Materials: Shoe polish, onion, chocolate, cinnamon, orange slice, coffee

Procedure: Select two teams to be blindfolded. Place the above items in a box. Let team members smell and identify (without touching). The team with the most correct answers is the winner.

28. Leading Question: How can you identify the "Mystery Substance"?

Materials: Spray bottle of perfume, small dish

Procedure: The teacher prepares a dish of perfume, labeled MYSTERY SUBSTANCE, outside the room. The dish is presented to class for identification. When guessed, the perfume is then sprayed into the air. What is learned about odor?

Place the dish in classroom for several days? What happens? Why?

29. Leading Question: What odors are pleasing?

Materials: Onion slice, cinnamon, orange slice, coffee, tea, peeled banana, ammonia, vinegar, water colors

Procedure: Place portions of the above substances in vials and cover them with aluminum foil. Label each substance with a letter and punch holes in the top. Pass the vial around the room, allowing each child to identify the contents and to record their guesses. What conclusions are arrived at?

30. Leading Question: Do all things have an odor?

Materials: Vinegar, milk, baking soda, water, ammonia, five beakers

Procedure: Place the above substances into water beakers. Children should smell each solution. CAUTION: DO NOT TASTE!!! What results are reached?

31. Leading Question: Do rocks have odors? What is the smell?

Materials: Shale, slate, marble, limestone

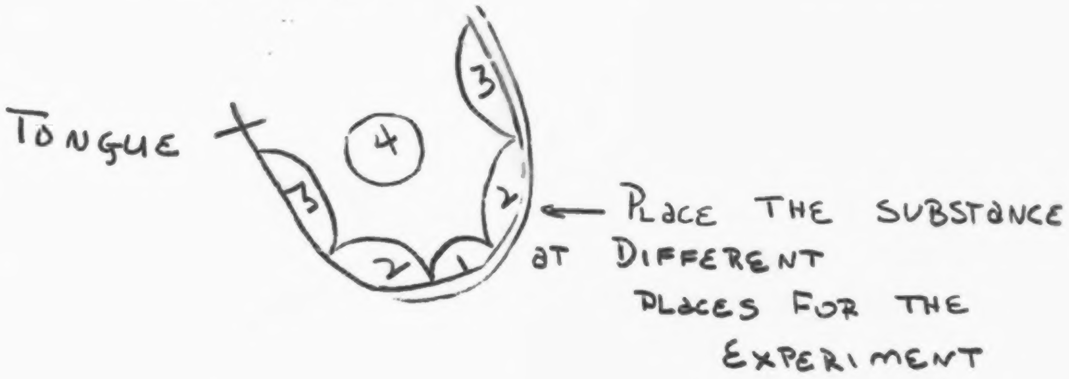
Procedure: Take the samples and wet each rock. Some will smell alike. Identify those which smell like clay and those which smell like chalk.

32. **Leading Question:** Is taste the same on all parts of the tongue?

Materials: Sugar, salt, vinegar, baking soda, coffee grounds, glass of water

Procedure: Place a few grains of sugar on the tip of the tongue. How does it taste? Cleanse mouth with water. Place sugar on the front sides of the tongue. Remember the taste. Cleanse mouth and place sugar on the back sides of the tongue. Discuss the taste. Cleanse the mouth and place sugar on the back center portion of the tongue. What is the difference?

Follow the same procedure with baking soda, salt, vinegar.


TONGUE
4
3
3
2
2
1
PLACE THE SUBSTANCE AT DIFFERENT PLACES FOR THE EXPERIMENT

33. **Leading Question:** How do you taste?

A. **Materials:** Sugar, paper towel

Procedure: Dry the end of your tongue with a paper towel. Put a pinch of sugar on the end of the tongue. Keep the mouth open. What is the taste?

Now close the mouth. What is the taste?

B. **Materials:** Slice of apple, carrot, celery, cheese, bread, blindfold

Procedure: Blindfold a student and place a tray of food in front of him. Guess what is on the tray? How else can you find out without looking?

34. **Leading Question:** Are some tastes stronger?

Materials: Clothespin, chocolate bar

Procedure: Instruct a child to put a clothespin on his nose. Feed him a bite of chocolate bar without telling him what it is. Ask the child how it tastes. Remove the clothespin and ask him how it tastes now. Make a comparison.

Note to teacher: Taste and smell compliment one another.

35. Leading Question: Do look alikes, taste alike?

A. Materials: Salt, sugar, lemon extract

Procedure: Dissolve one half teaspoon of each ingredient in a cup of water. Then dissolve three tablespoons full in same amount of water. Taste each of the eight mixtures and discover the difference.

Note to teacher: This is a wonderful place to discuss safety rule: Know what you are putting into your mouth. Don't take a chance!

B. Materials: Water, sugar water, salt water

Procedure: Place both of the above colorless, odorless liquids in separate beakers. ALLOW EACH MEMBER OF THE CLASS TO DIP A FINGER INTO EACH BEAKER AND TASTE. Try to identify each. What is the result? Discuss.

36. Leading Question: Is there a difference?

Materials: Lump of sugar, glass of water, timer, eye dropper

Procedure: Drop a sugar cube into half a tumbler of water and observe what happens. Let it stand fifteen minutes. Take an eye dropper of liquid from the top and taste, next take a dropper full from the bottom. Compare the two.

37. Leading Question: What do you taste?

A. Materials: Shale, limestone, slate, marble

Procedure: Taste each of the four rocks and decide whether they taste like clay or chalk. Record your results.

B. Materials: Salt, tobacco, sugar, lemon, cinnamon, baking soda, banana, flour

Procedure: Devise a poster with the titles TASTE and SMELL. Permit class to classify materials according to whether taste or smell was more helpful in identifying them.

38. Leading Question: What substance is this?

Materials: Salt, bicarbonate of soda, sugar

Procedure: Place a salt water solution on a burner. Let the water boil away. What is left? Taste it and identify the substance. Do the same with bicarbonate. What will happen to sugar?

39. Leading Question: Is the time length important in a "feeling" game?

Materials: Box, sand paper, piece of plastic, rubber ball, cotton, spoon, and a straw

Procedure: Blindfold a child and let him feel in the box for an object. Remove it and guess what it is. Each time the time length is shortened. What is discovered? Let each child have a turn. Some children might add new objects for the others to guess.

40. Leading Question: Do you only feel with your hands?

Materials: Ice cube, hot iron, cold iron, blindfold

A. Procedure: Place an ice cube on the underarm of a blindfolded child. What was his first reaction? Why?

B. Procedure: Instruct a child to wet his finger and touch a hot iron. Then tell him to wet the finger and touch a cold iron. What was the difference? How did you know there was a difference? Where was it felt?

Compare these two activities.

41. Leading Question: Can you tell objects apart just by feeling them?

Materials: Bag, bottle cap, feather, tooth brush, toy soldier, ping pong ball, piece of yarn, whistles, cork, acorn, eraser, nail, crayon, thread, safety pins, rubber band, marble, paper clip

A. Procedure: Place all of the above objects in a bag. Ask one child to reach in the bag for a specific object. Discuss!!!

B. Procedure: Ask a blindfolded child to put a pair of gloves on, then instruct him to select any object from the table and try to identify it. Next, try the same activity without gloves. What is the conclusion? Why?

42. Leading Question: How does your brain know?

Materials: Magazines, paper, paste, variety of objects, pencil and paper

A. Procedure: Children should discover pictures in magazines and classify according to which sense would help identify the real object.

B. Procedure: Arrange a variety of objects on a table. Place a sheet on top. Give each child in the class a pencil and paper. Take the sheet from the table and permit student to observe objects for three minutes. Replace the sheet.

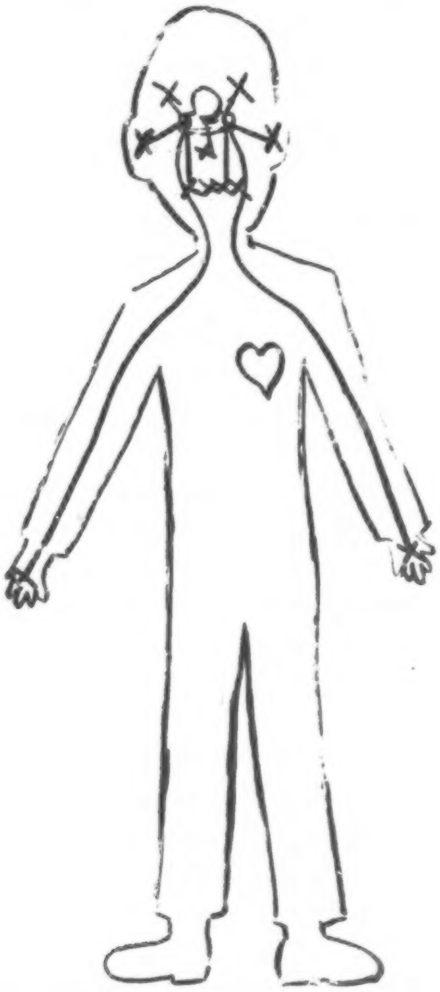
Instruct the children to record any objects that they remember from the past--seeing, hearing, feeling, touching, or tasting. The pupil with the longest list will be the winner.

Note to teacher: The variety of objects should be plentiful. No writing is permitted while the sheet if off and the objects are being observed.

43. Leading Question: What path do messages take to the brain?

Materials: Wood, paint, switches, electrical wires, lamp socket and a bulb

Procedure: This is a teacher's project. Ask a carpenter to cut a life size human figure from wood. An electrician should equip the brain region with a lamp socket and a bulb. He then should extend wires from the head region (lamp socket) to the hands, eyes, ears, nose, and mouth. At these latter regions switches should be attached to the board, connecting the senses to the brain (head) by means of wires. What will happen when a switch in the hands is turned on? How does your head know when you burn your finger?



44. Leading Question:	How can you tell when objects are different or alike?
A. Materials:	Watch, orange, pencil
Procedure:	Close eyes and find which is the pencil. How did you know the pencil? the orange? the watch?
B. Materials:	Carrot, bird in cage, rose, apple, ice, salt, yarn, cat, sugar, glass of water, and thread
Procedure:	Display these articles on a table and allow class to group them according to similarity. How did you know likeness?
C. Materials:	Lemon extract, lemonade, lemon candy, lemon cake
Procedure:	Blindfold a student. Ask this student to identify the materials by smell alone. What will happen? Why is it necessary to have more than one sense? Discuss.

D. Materials: Sand, salt, sugar

Procedure: The teacher should place similar piles of salt, sand and sugar on a table. Blindfold a child. Ask this child to identify the sand by touch alone. Is this possible? Why is it necessary to have more senses? Discuss.

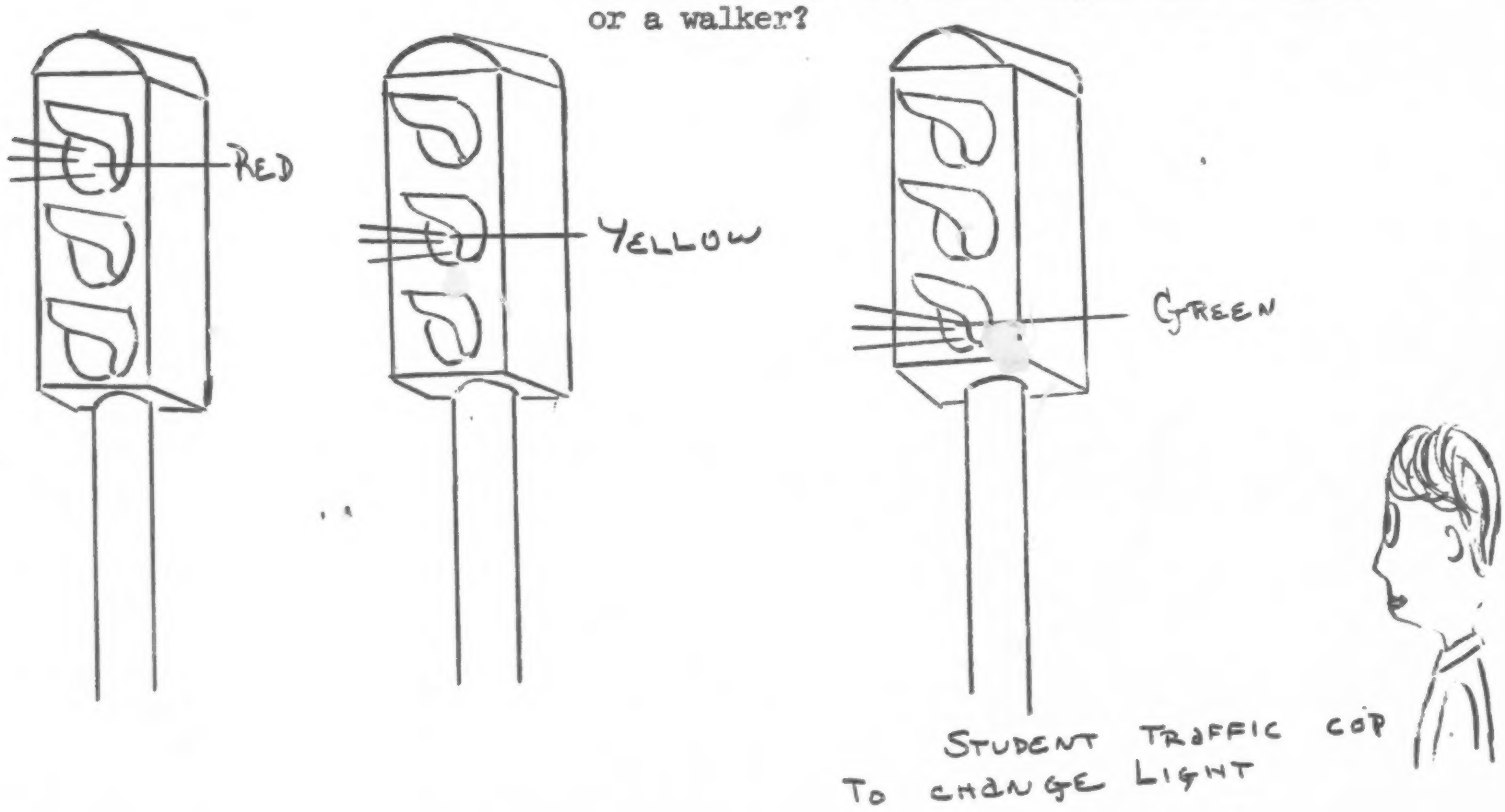
E. Materials: Red paint, red shoe dye, red beet juice

Procedure: The teacher should prepare beforehand. Place a teaspoon of each of the above items in a tumbler of water. Mix the liquids so they appear similar in color. Ask a student to identify liquids by sight alone. Why is necessary to have more than one sense? Discuss.

45. Leading Question: How do your senses help you to react to stimuli?

A. Materials: Traffic light (separate pictures or model)

Procedure: How does a traffic light help a driver and a walker? Discuss!!! A student should be shown a separate traffic light (green or red). He should respond by either walking or stopping. Discuss what a driver would do. What does a yellow light tell a driver or a walker?



B. Materials: Paper, tape

Procedure: Roll the paper into a tube and tape. Place one end on the chest of another student and the other end to your ear. What is heard?

C. Materials: Plastic curling fish, candy wrapper

Procedure: Place the curling fish in a dish of water. Remove the fish and keep it in your palm. What happens? Why?

Crunch a candy bar wrapper in your hand. Lay it on the table. What is seen? Why?

Note to teacher: Curling fish are available at the Central Science Library.

HUMAN BODY

GRADE 3

HUMAN BODY

The Ear - The Organ of Hearing

Grade 3

UNDERSTANDINGS TO BE DISCOVERED	RELATED ACTIVITIES
The human body is equipped to hear.	1, 2
The ear is the organ of hearing.	1, 2, 19, 36
Next to seeing, hearing is the most highly developed sense.	1
The ear gathers in sound waves from the air, producing sensations in the brain.	1, 2, 3, 4, 5, 6, 18, 19
To hear, four things are needed; a vibrating body, a conductor of sound, ears to receive sound waves, and the brain.	4, 5, 6, 7, 9
Normal hearing in both ears is necessary for detection of most sound sources.	8, 21, 22, 23
Higher animals receive sounds through their ears.	1, 2, 32
Animals have many different kinds of hearing organs.	29, 30, 31, 32, 34
The ear consists of three main parts; the outer ear, the middle ear, and the inner ear.	2, 10, 14, 16, 36
The outer ear is the part that can be seen.	1, 2, 10, 19
The shape of the outer ear allows it to catch sound waves which are directed into the hearing canal.	1, 2, 3, 10, 11, 26, 36
The sound canal contains small hairs and wax which help keep out dirt and insects.	28
The hearing begins at the end of the sound canal in the middle ear.	1, 2, 5, 12, 13, 36
The eardrum which is stretched across the sound canal is a thin, delicate sheet of rubbery skin.	13, 19, 36
Sound waves cause the eardrums to vibrate.	12, 13, 36
In the middle ear there are three small bones (ossicles) called hammer, anvil and stirrup.	1, 2, 14, 15, 19, 36

UNDERSTANDINGS TO BE DISCOVERED (Cont'd)	RELATED ACTIVITIES
The ossicles amplify the vibrations of the eardrum.	14, 36
The hammer is attached to the inner side of the eardrum.	1, 2, 15, 36
When the eardrum vibrates, the hammer vibrates.	15, 36
Vibrations are passed along to the anvil.	1, 2, 15, 36
The anvil passes vibrations along to the stirrup.	1, 2, 15, 36
The stirrup is attached to the membrane which covers the oval window of the inner ear.	1, 2, 15, 36
The inner ear (cochlea) is a snail-shaped spiral or tunnel in the bone filled with liquid and divided into three canals.	1, 2, 16, 19, 36
The membranes of the cochlea contain thousands of hairlike cells which are sensitive to vibrations.	16, 17
The auditory center in the brain interprets impulses.	2, 4, 16, 18 19
The inner ear also contains three bony semicircular canals.	20, 35
Man's balance depends on the semicircular canals.	20
The Eustachian tube is the connection between the middle ear and throat which serves to equalize air pressure on both sides of the eardrum.	1, 2, 27
The ears are easily damaged and proper care of the hearing organ contributes to man's well-being.	8, 20, 22, 23, 24, 25
The auditory nerve carries the sound messages from the cochlea to the brain	1, 2, 18, 19

The Ear - The Organ of Hearing

Grade 3

ACTIVITIES

1. Leading Question: What is the composition of the hearing organ?

Materials: Three-dimensional model of the ear

Procedure: Request a three-dimensional model of the ear from the Central Science Center. Have the children observe the complete model of the ear. Look at the part of the ear we can see. Is this the correct shape for gathering in sounds? Why? What is this part called? (Outer ear) Open up the model and find to what the outer ear leads. What does the part leading from the outer ear resemble? (Tunnel) What is at the end of the short sound tunnel? What does it resemble? (Drum) Which part looks like part of a drum? (Eardrum) Why? What is on the other side of the eardrum? (Bones) How many little bones are there? To what do these bones lead? What shape is it? (Spiral-shaped like a snail shell) What is inside this part? Where does this lead? If sound goes into the ear, where does it end? (Brain) How does it finally get to the brain? (Nerves of hearing)

Display the model of the ear in the classroom for about a week. Allow each child to remove the parts and reassemble them again.

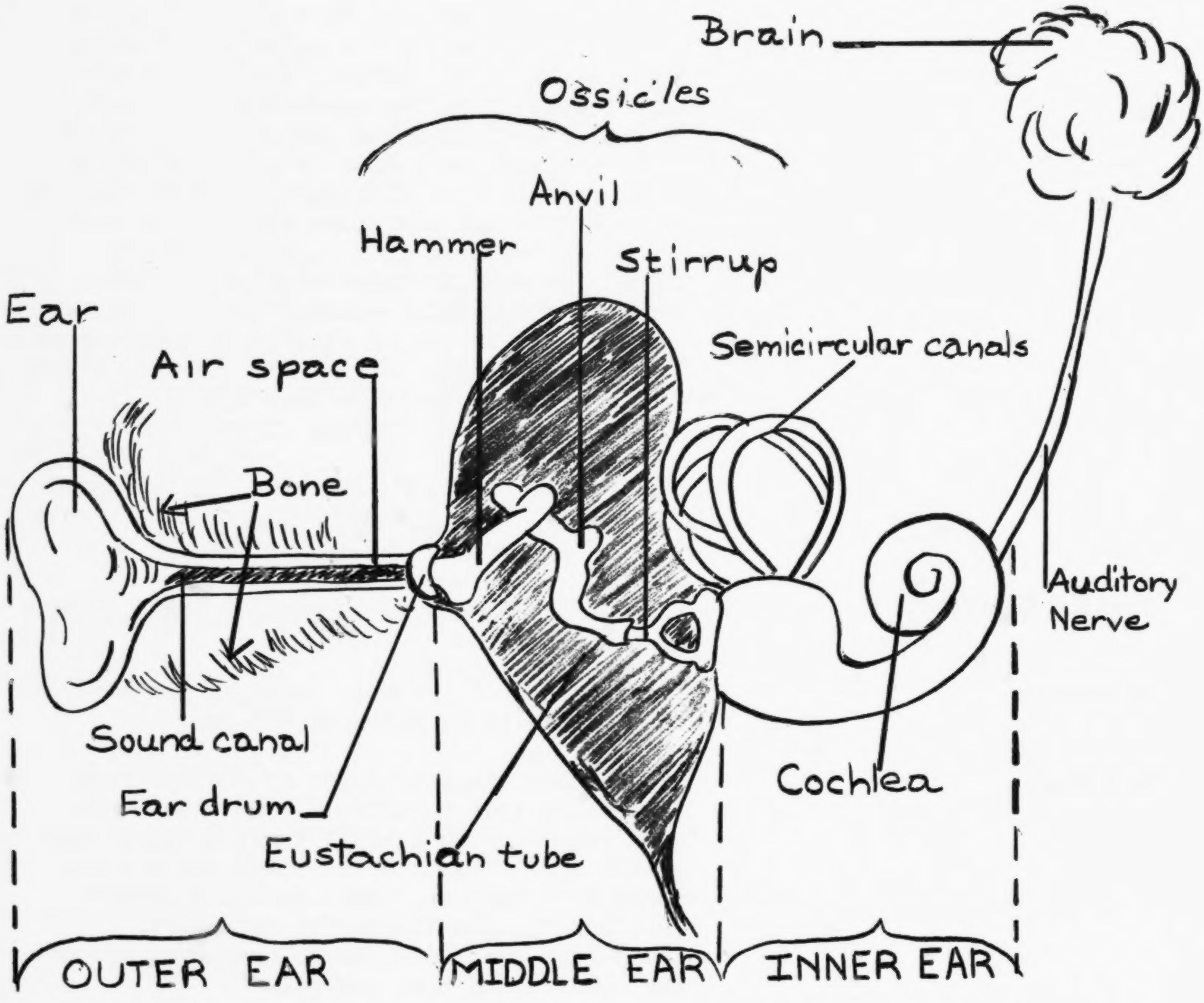
2. Leading Question: How can we better understand the human organ of hearing?

Materials: Transparency of the ear, overhead projector, three dimensional model of the ear

Procedure: Request the transparencies of the ear from the Visual Aids Department. Use the overhead projector to exhibit the transparencies of the ear. Point to the outer ear and ask a child to name it. What is its purpose? Continue the questioning of each part: auditory nerve. Use the colored overlays of the eardrum and the cochlea.

If we were to divide the ear into three parts, how much would we include with each part? What could we call the first part? (Other ear) What could we call the second part? (Middle ear) What could we call the third part? (Inner ear)

Have a child come up to the projector and point to a part of the ear, and name it. Have another child find the same part of the ear on the three-dimensional model. Do this for each part of the ear.


Brain
Ossicles
Anvil
Hammer
Stirrup
Ear
Semicircular canals
Air space
Bone
Auditory Nerve
Sound canal
Cochlea
Ear drum
Eustachian tube
OUTER EAR
MIDDLE EAR
INNER EAR

3. Leading Question: How can we help our ears to gather in more sounds?

A. Materials: Large piece of construction paper, scotch tape

Procedure: Roll a large sheet of construction paper into a megaphone and fasten it with scotch tape. Hold the small end to one ear. Listen to the sounds around the classroom. Now listen without the magaphone. Does the megaphone change the sounds? How does it make the same sounds different? When would a device such as this aid in hearing sounds better? What does the megaphone represent? (larger ears)

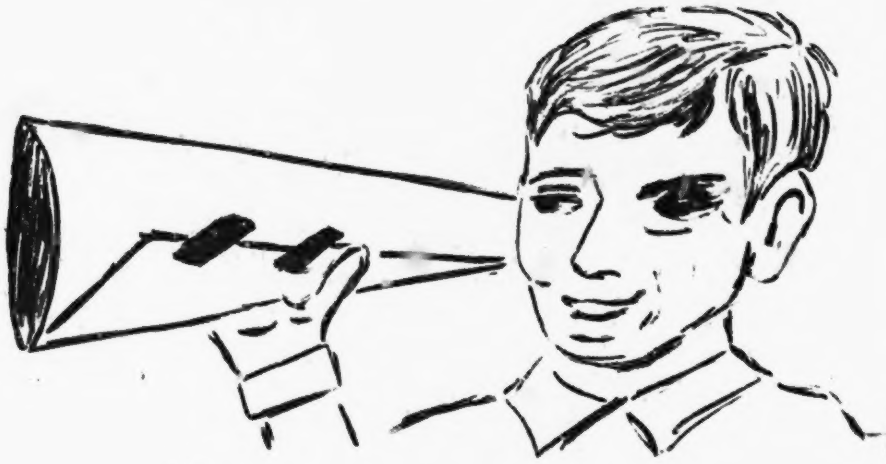
Think of some animals who have larger ears. How do larger ears help these animals?

B. Materials: None

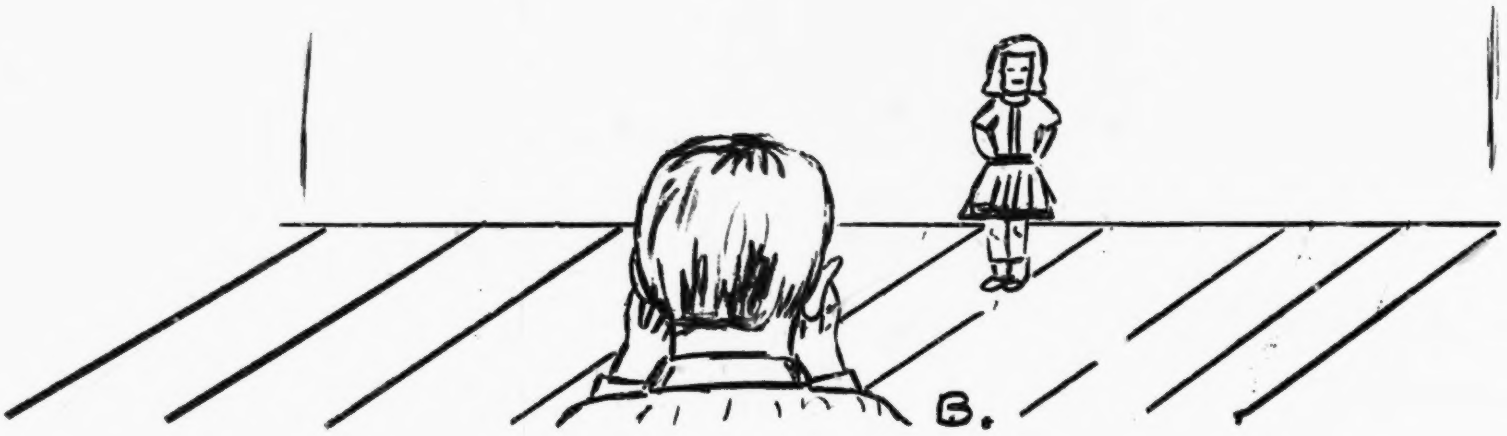
Procedure: Choose a child to stand at the far end of the classroom. Have him say something in a soft voice. Ask him to choose another child at the opposite end of the room to repeat what he has heard. Is he repeating exactly what was said? Have the speaker repeat what was said while the listener cups his ears with his hands. Do the cupped ears change the sound? Why?

C. Materials: Long piece of garden hose

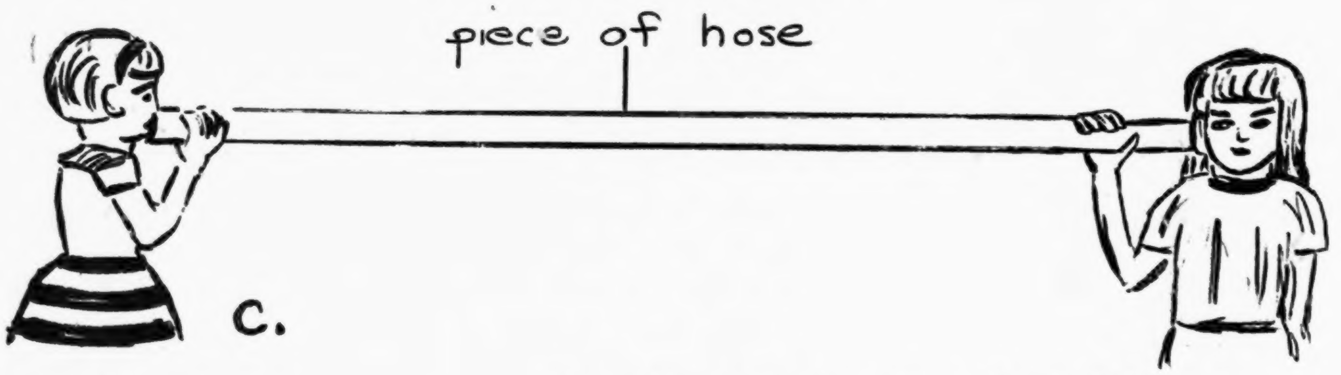
Procedure: Stretch a long piece of hose out straight. Have one child listen in one end while another child speaks in the other end. Next, speak and listen without the use of the hose. Does the hose help the ear to hear better? Why? What does the long piece of hose do for the ear?



A.



B.



C.

4. Leading Question: In order to hear, what four things are necessary?

A. Materials: Drum, drumsticks

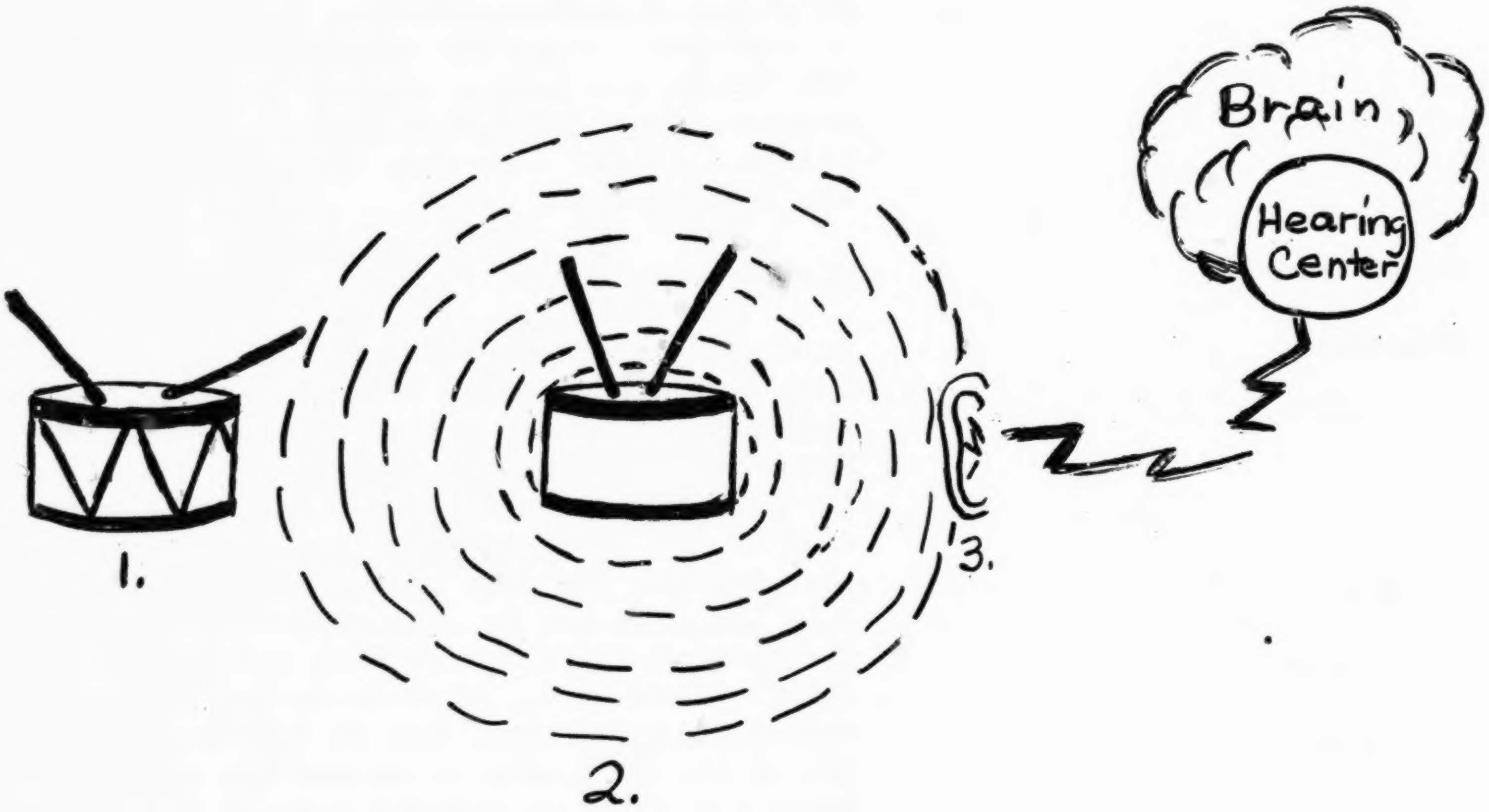
Procedure: Ask a child to beat a drum lightly. Ask the children to sit and think for a few minutes about what is happening from the time they see the child beating the drum until they hear the sound. Think of four things that are necessary in order to hear any sound. List the four things on the chalk board as the children name them.

(The teacher should be able to draw from the class the following points.)

1. Something that vibrates (drum)
2. Something to carry the vibrations (air, solids, water)
3. Ears to receive the vibrations.
4. The brain - hearing center

B. Materials: None

Procedure: Ask the children to draw and number the four things necessary for hearing.



5. Leading Question: What does a vibrating body produce in order that our ears are able to detect the source of sound?

A. Materials: A twelve inch ruler

Procedure: Ask a child to place a wooden ruler near the end of his desk so that about 9 inches extends over the edge. Have him grip the short end firmly to the desk. With the other hand, snap the opposite end of the ruler. What two things are happening? What can be seen? (vibrations) What can be heard? Can we determine if the vibrations are registering in the brain? How can we tell? Can we feel the eardrums vibrate? What will the vibrations have to travel through in order to make the eardrums vibrate?

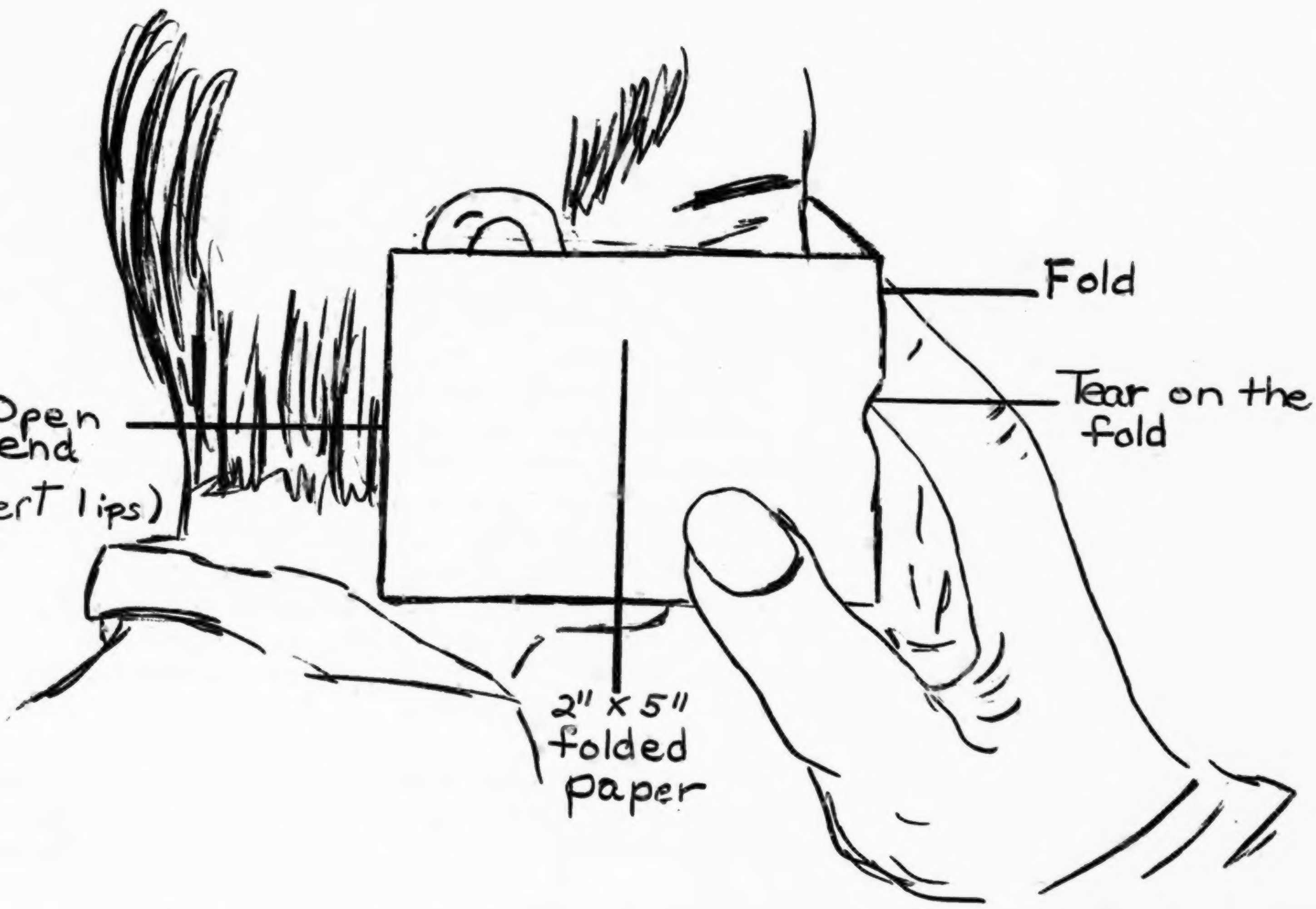
Try the experiment several times. Each time shorten the vibrating end of the ruler. Does this change anything? What is happening to the sound each time the vibrating end is shortened?

B. Materials: Wooden cigar box, rubber band

Procedure: Remove the lid from a wooden cigar box. Stretch a rubber band across the open side of the box. Pluck the rubber band. What two things are taking place? Do we hear anything when the rubber band stops moving back and forth? How does the brain detect the vibrations?

C. Materials: Strip of paper 2" x 5"

Procedure: Fold a strip of paper 2" x 5" in half. Tear a small piece of paper from the center of the fold. Hold the folded paper between the fore-finger and middle finger. Do not cover the hole with your fingers. Place the open ends of the paper to your lips by inserting them between the open ends of the paper. Be sure the lips are as near as possible to the fingers which are holding the folded strip. Blow hard What do we feel? What causes this feeling? Can we hear anything? How is the body able to detect the sound? Trace the sound vibrations through the ear to the brain. What do the sound waves travel through between the vibrating object and the outer ear?



6. Leading Question: If we were able to see sound waves in the air, what would we see?

A. Materials: Small tub or bucket, water, pebble

Procedure: Fill a small tub or bucket with water. From a distance of several feet, drop a pebble into the tub of water. How does the water move? In which direction does it move? (ripples expanded in circles from the center of the impact)

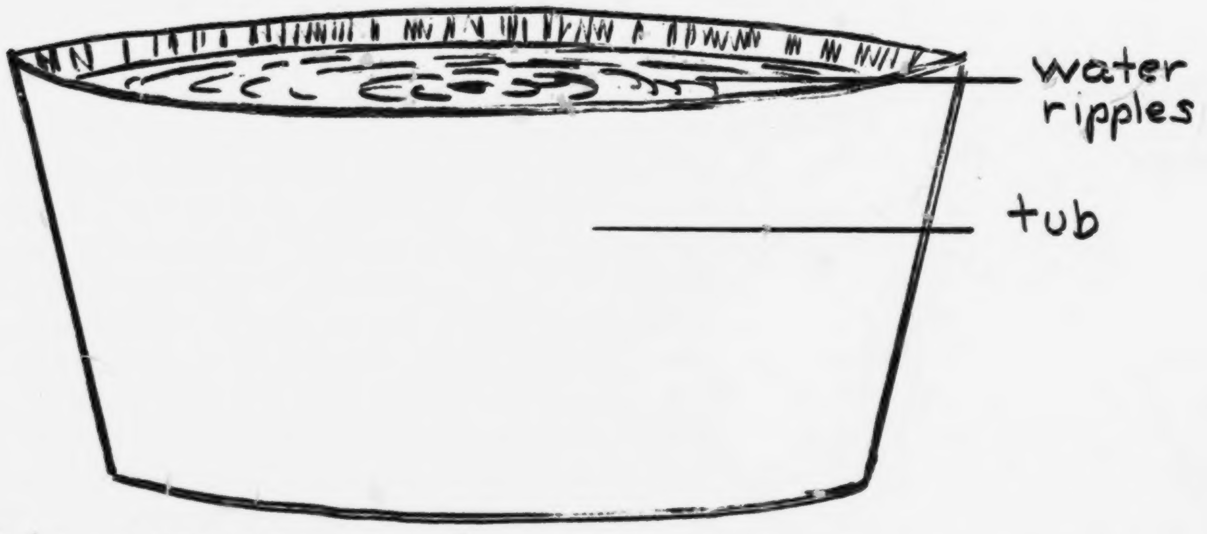
B. Materials: A set of rhythm band cymbals

Procedure: Use a set of rhythm band cymbals from the music room. Have a child stand in front of the class and hold the cymbals in the correct position. Strike them together lightly. Ask the children to raise their hands when they hear the noise. Now have a child stand in the middle of the room while the other members spread out in all directions around the room. Have a child leave the room and go down the hall a little distance. Strike the cymbals together sharply. Ask the children how many of them hear the sound? Does the boy in the hall hear the sound? Try the experiment again while a child stands up on the teacher's desk, another child stands in the hallway, and one child goes halfway down the stairs. Strike the cymbals sharply again. Does the child standing on the desk hear from above? Does the child standing halfway down the stairs hear the sound? What does this tell us about the directions of sound waves? Do the sounds travel in one straight line? How do we know? Is it possible that the sound waves travel in another way rather than in straight lines? Think of the ripples on the water when a pebble was thrown into the tub of water. Does that give us a clue? Since we are able to hear from all different positions, including above and below, how might we picture sound waves if it were possible to see them in the air?

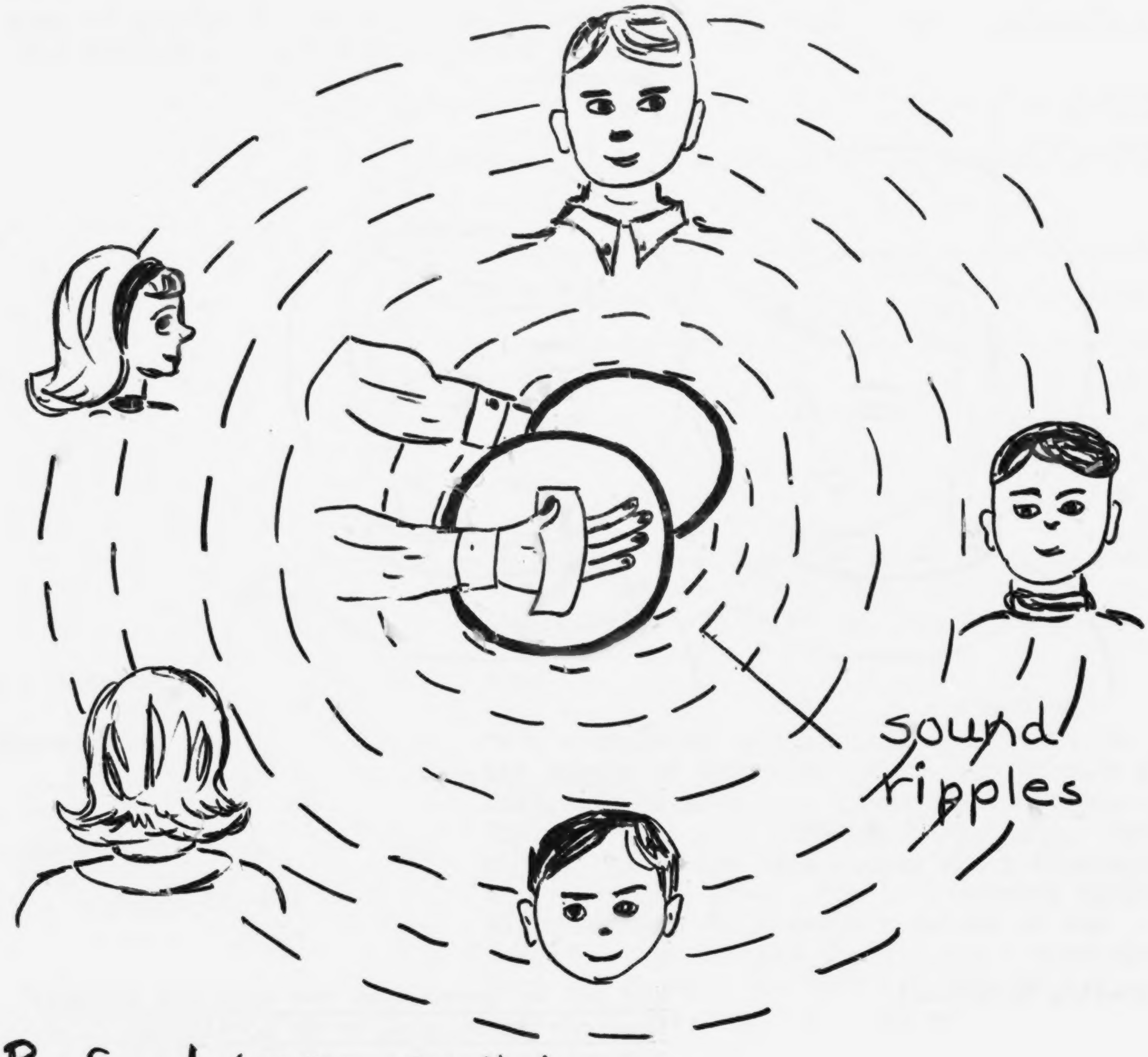
Have the children draw a picture of what they think the sound waves would look like. How can we compare water ripples with air ripples?

Note to teacher:

Air is made up of molecules. As the cymbal vibrates the air molecules near the vibration source are pushed together. These "packed" molecules move away from the cymbal like a ripple. When the vibrating cymbal moves the other way, the molecules behind the ripple are left far apart. As the cymbal moves back, another ripple follows the first.



A. Water waves can be seen



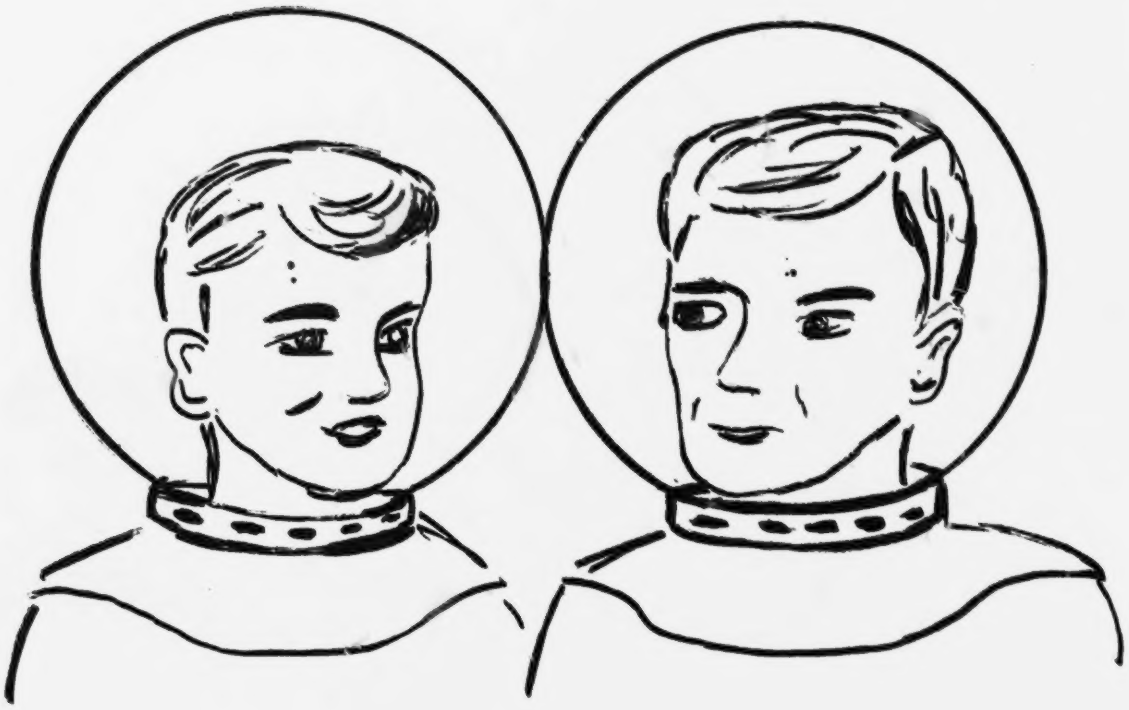
B. Sound Waves can't be Seen.

7. **Leading Question:** Since there is no air, to carry vibrations, on the moon, will astronauts be able to hear one another talk?

Materials: None

Procedure: Ask the children to think about how astronauts on the moon will use their ears since there is no air to conduct the vibrations

Note to teacher: When using the radio, the microphone and speaker must be carried inside the space suit. The space men will make their helmets come together, allowing sound vibrations to pass through the solid material and vibrate the eardrums.



8. Leading Question:	How can we prove that two ears are better than one in helping us to locate the correct source of sound?
A. Materials:	Paper for chart making
Procedure:	Have the class stand in a circle with one child in the center with closed eyes. Have the child in the center call the name of a classmate. The child, whose name is called is to make any kind of noise. After calling a name and listening, have the center child turn and face in the direction from which he thinks the sound is coming. Try this about 10 times. Keep a record of the correct responses. Next, use the same procedure but have him cover his left ear tightly. Continue to record the responses for this ear. (ten times) Try the experiment ten times with the right ear.

Study the chart and come to some conclusions:

	Correct Responses	Incorrect Responses
Listening with two ears	111111111	1
Listening with left ear	11	11111111
Listening with right ear	1	111111111

Do two ears work better than one? Why should we try to preserve the hearing in both ears?

List some occasions when it is very important to have two ears rather than one.
List some safety rules for caring for the ears.

B. Materials: None

Procedure: Have a child sit blindfolded on a chair in the center of the room. Allow him to pick a classmate to move quietly around the room. The classmate will clap his hands once. The blindfolded child will decide which direction the sound came from. Try this several times while another child keeps a record of the correct responses and the incorrect responses. Next try it with the left ear covered and then with the right ear covered.

Did you hear better with one ear or two ears? If a child is mistaken too often, using two ears, what may be the reason?

9. Leading Question: Does your tape-recorded voice sound like it always sounds?

Materials: Tape Recorder

Procedure: Choose several children to record their voices on a tape recorder without the knowledge of the rest of the class.

Bring the tape recorder before the class to listen to the recording. Ask the class if they can identify the voices on the recording Question each recorder as to what he thinks about his own voice. Does it sound the same as his unrecorded voice sounds to himself? Why?

10. Leading Question: What is the purpose of outer ears?

A. Materials: Funnel, quart can, empty soda bottle

Procedure: Ask the children to think of a way of pouring water from a large container into a bottle without spilling it.

Try this method. Fill a large can with water. Insert a funnel into the mouth of an empty soda bottle. Pour the water from the can into the bottle. Be careful not to pour too fast. Is it possible to pour the water into the bottle without spilling it? Why? How would a smaller funnel work? Would a larger funnel work better? Why? Would it be possible to pour water into the bottle without a funnel?

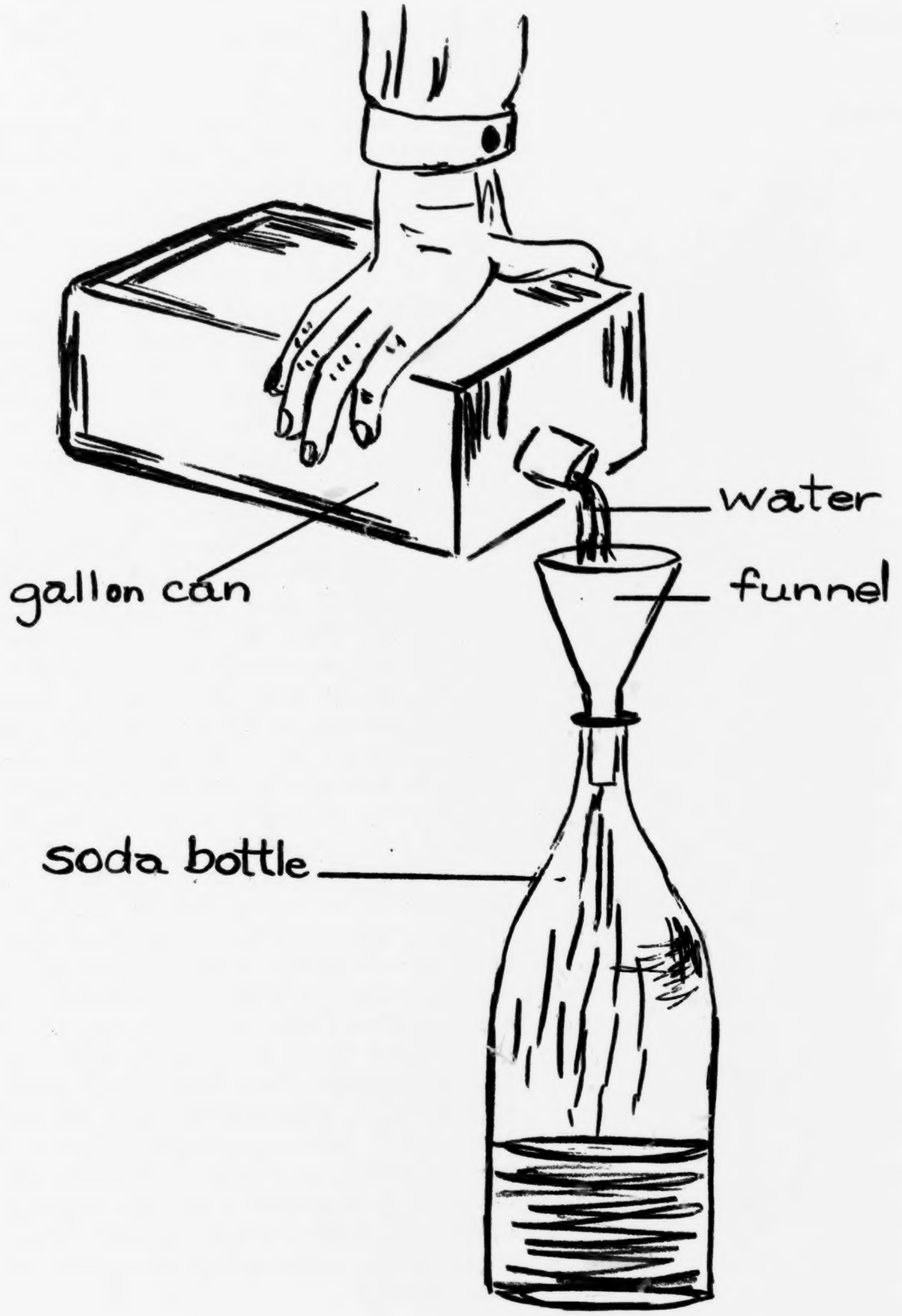
How is the ear like a funnel? Does the size make any difference? Why?

Are outer ears necessary in order to hear?

B. Materials: Small dinner bell

Procedure: Have a child ring a small dinner bell a short distance from the ear of a classmate. Ask the class to draw a picture of how they think the sound waves would look as they are funneled into the ear.

Draw a picture of the sounds of a drum as a child beats it. Show the sound waves entering the ear. What do outer ears do with the sound?

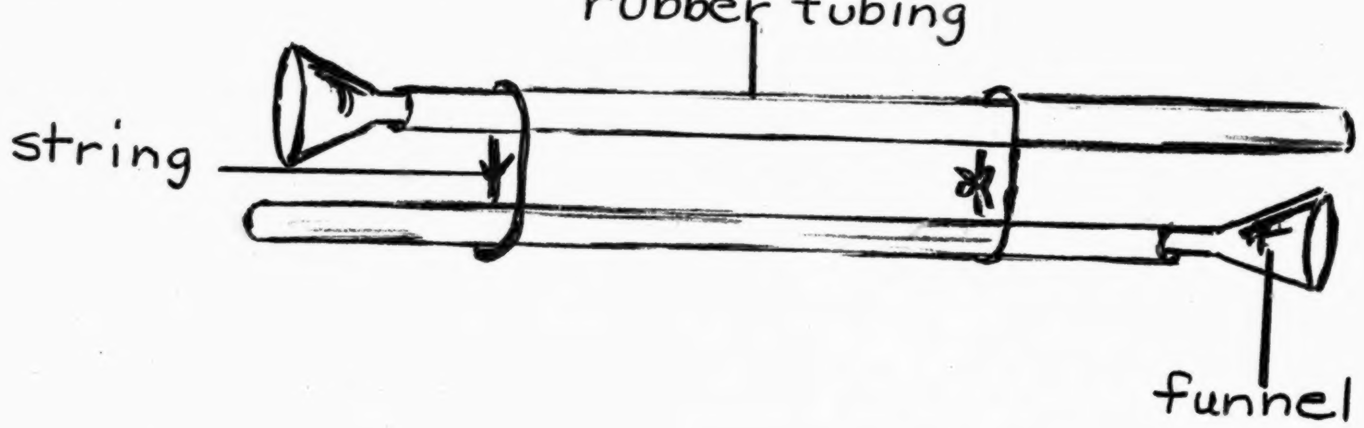

water
gallon can
funnel
soda bottle

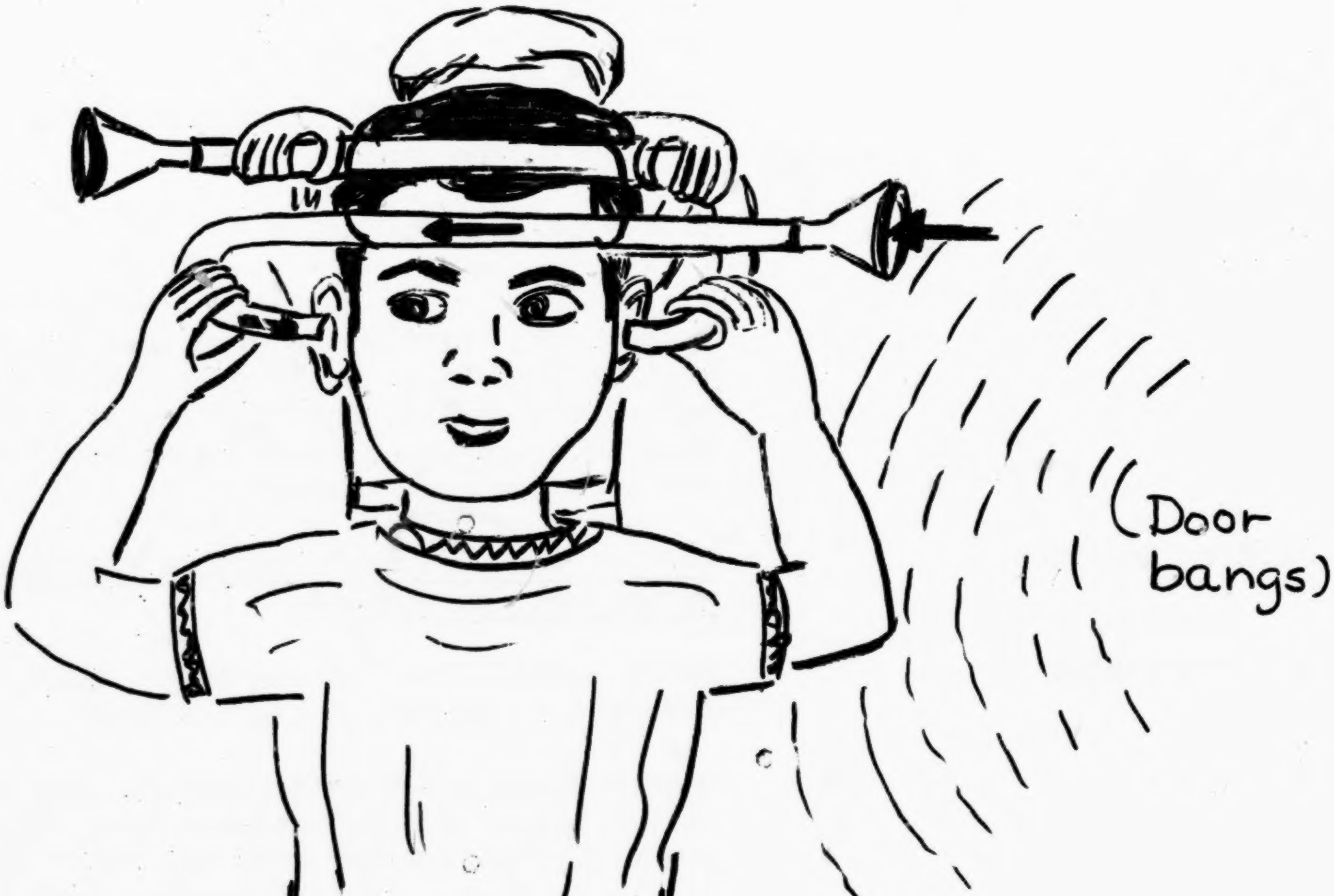
11. **Leading Question:** How can we be sure that the outer ear acts as a funnel to catch sound waves?

Materials: Two funnels, two pieces of rubber tubing, string

Procedure: Tell a member of the class to pretend to swap ears with himself. Get two funnels and two pieces of rubber tubing. Have a child insert a funnel into one end of each piece of rubber tubing. Lay the funnels and tubing flat on a desk so that one funnel is on the right and the other funnel is on the left. Fasten the two pieces of tubing with two pieces of string. Keep them about an inch apart. With the help of another child, lift the tubings so that both can be held across the forehead. Ask the helper to hold the tubing in place while the other child holds the ends of the two tubes to his ears. The tubing held to the right ear will have the funnel facing toward the left and the tubing placed to the left ear will have the funnel facing toward the right. Ask the child to close his eyes and listen to sounds from the left and the right. Allow him to tell the class which ear is hearing a certain sound. Have a child keep a record of the number of times a correct or incorrect response is made. After trying this a few times ask the recorder to report how the experiment is proceeding. How many times was he incorrect? What possible reason is there for an incorrect response? Now try the experiment without the apparatus. Have the recorder keep an account of the correct and incorrect responses. When the sound comes from the left why is it possible to hear it better with the right ear? Using the apparatus, when the sound comes from the right is it possible to hear it with the left ear? Does this experiment prove that our ears act as funnels through which sound waves are directed into the hearing canal? Since the demonstrator didn't depend on his outer ears, what acted as outer ears in this experiment?

Note to teacher: When the children have discovered that, with the use of the apparatus, the sound coming from the right is heard in the left ear and vice-versa, then the experiment has served its purpose.


rubber tubing
string
funnel


(Door bangs)

12. **Leading Question:** How can I construct a working model of the eardrum?

A. Materials: Tin can, rubber balloon, rubber band, dry cereal

Procedure: Ask a child to bring in to school a tin can with the top and bottom removed. Have him stretch rubber from a balloon across one end of the can and secure it tightly with a rubber band. How does this represent an eardrum?

Put several pieces of dry cereal on top of the stretched rubber. Ask the child to kneel on the floor and look up into the open end of the can while a friend holds the can for him. Have the child place his mouth near the opening but not against the can. Speak into the can by repeating a word such as "bang-bang-bang." What is happening to the cereal? What is causing the cereal to bounce up and down? What is happening to the stretched rubber? How do we know? Is it possible to see the rubber vibrate? If not, how can we be sure it vibrated?

How can we liken the stretched rubber across the can to the real eardrum?

B. Materials: Drum, few grains of salt

Procedure: Place a few grains of salt on the middle of a drumhead. Strike the drum near the edge. What is happening to the salt? What is making the salt bounce? How can we apply this to sound waves hitting the eardrums? How does the drum compare to an eardrum?

13. **Leading Question:** How can we be sure the eardrum vibrates when we are hearing sounds?

A. Materials: Round oatmeal box, tissue paper, glue, fragment of mirror, a light source

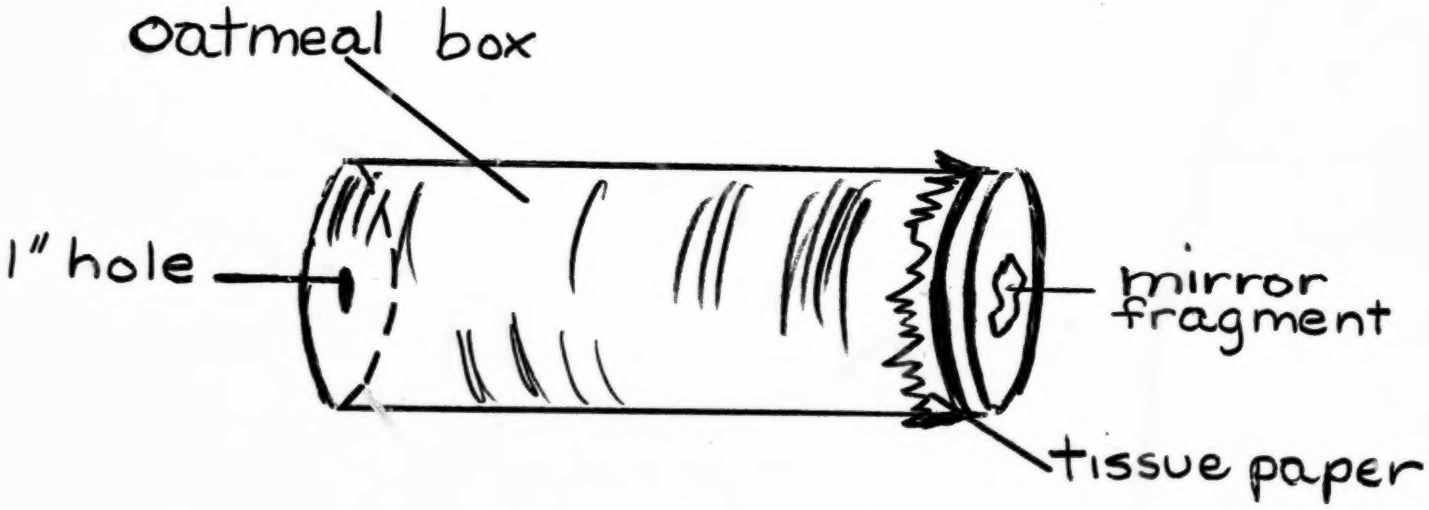
Procedure: Have a child cut a hole about an inch wide in one end of a round oatmeal box. Glue a piece of tissue paper over the other end of the box. Glue a small fragment of mirror in the middle of the tissue paper. Place the mirror side so that it is facing outward Dampen the tissue paper to make it taut.

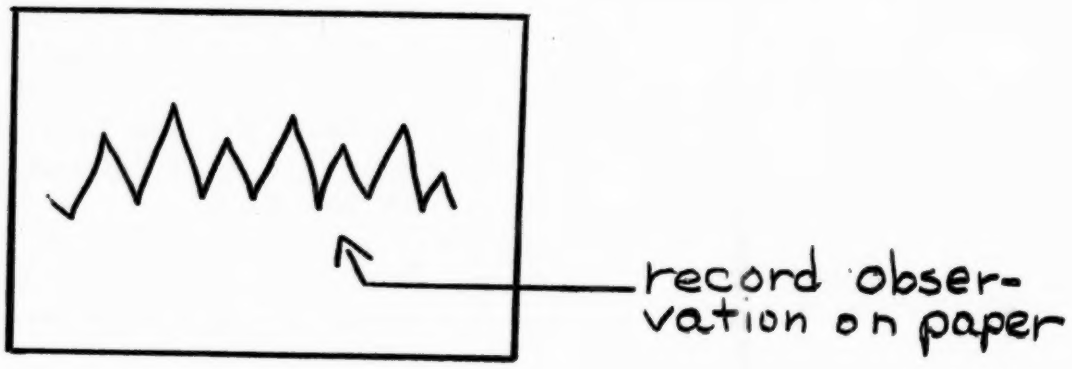
Ask the child to put his mouth to the hole in the one end and to speak in a normal voice into the hole. Hold the box so that light is reflected on the mirror. Watch the line of reflection on the wall or ceiling.

Have each child record on a piece of paper how the line on the ceiling looked to him. As the voice sounds, what is happening to the tissue paper? What do you see on the wall? What does this prove about sounds? What is happening in the air? What is happening to the eardrum when a sound is made?

B. Materials: Bell, small stick

Procedure: Tell a child to hit a bell with a small stick. Does he hear a sound? Have the child touch the bell with his fingers. Does he feel the vibrations? What is the vibrating bell doing to the air? What is the vibrating air doing to the eardrums?





14. **Leading Question:** What are the common names of the three bones (ossicles) in the middle ear? Are these good names?

Materials: Model of the ear

Procedure: Request the model of the ear from the Central Science Center. Dissect the model of the ear. Locate the three bones in the middle ear. Examine the shape of each bone.

Investigate some science books for the correct name for each bone. Ask the children if these are correct names for each of the bones. Investigate the purpose of each bone. What does the vibrating eardrum do to these bones?

Note to teacher: The middle ear is an airy little chamber about half as big as a thimble. The chamber is occupied by three small bones. (hammer, anvil, stirrup) The hammer is $\frac{1}{4}$" long. The vibrations in the middle ear are magnified between 20 or 30 times.

15. **Leading Question:** How do we know that bones carry vibrations?

Materials: Wrist watch

Procedure: Have a child place a wrist watch between his teeth. Plug both ears so that the outer ears will not pick up vibrations. Can the ticking of the watch be heard without the use of the outer ears? What is vibrating?

Tell the child to keep his ears plugged while he holds the watch in his hand. Can the ticking of the watch be heard without the outer ears this time? Why?

Explain why the ticking is heard when the watch is held between the teeth rather than in the hand.

Note to teacher: Sound is conducted through the bones to the sound nerves and then to the brain.

16. **Leading Question:** How are vibrations carried through the cochlea, or the inner ear?

A. **Materials:** Chart of the cross-section of the cochlea (Drawn on the chalkboard)

Procedure: Tell the class to examine a chart with the cross-section of the cochlea. Ask a child to tell how many canals there are in the cochlea. What might be found in the canals? (liquid) What is extending into the liquid? (hair-like cells)

What is happening to the hair-like parts as vibrations enter the inner ear?

B. **Materials:** Piece of turkish toweling, aquarium, water.

Procedure: Look at a piece of turkish toweling and imagine the "pile" of the cloth to be compared to millions of hair-like cells in the cochlea. Have a child dip the turkish toweling into an aquarium filled with water. Lift the turkish toweling up to the surface of the water. Keep the toweling stretched out. Look up through the water to the underside of the toweling. what is hanging down in the water? Ask another child to put his hand down into the water near the bottom of the aquarium and to move it back and forth. Do the loops of thread move? What is causing them to move? In the cochlea, what causes the vibrations of the hair-like cells? (The vibrating liquid)

Note to teacher: Inside the spiral shell of the cochlea, are three canals containing fluid. Vibrations of the middle ear send waves through these canals like ripples in a pond. The membranes of the inner ear and the hair-like cells touching the ripples vibrate and cause them to send the message through the nerves to the brain.

C. **Materials:** An aquarium with plant growth in the bottom.

Procedure: If there is a fish aquarium in your classroom with plant like growing in the bottom it, have the children observe the plants swaying with the movement of the water. How can we compare this with the action in the canals containing liquid and hair-like cells?

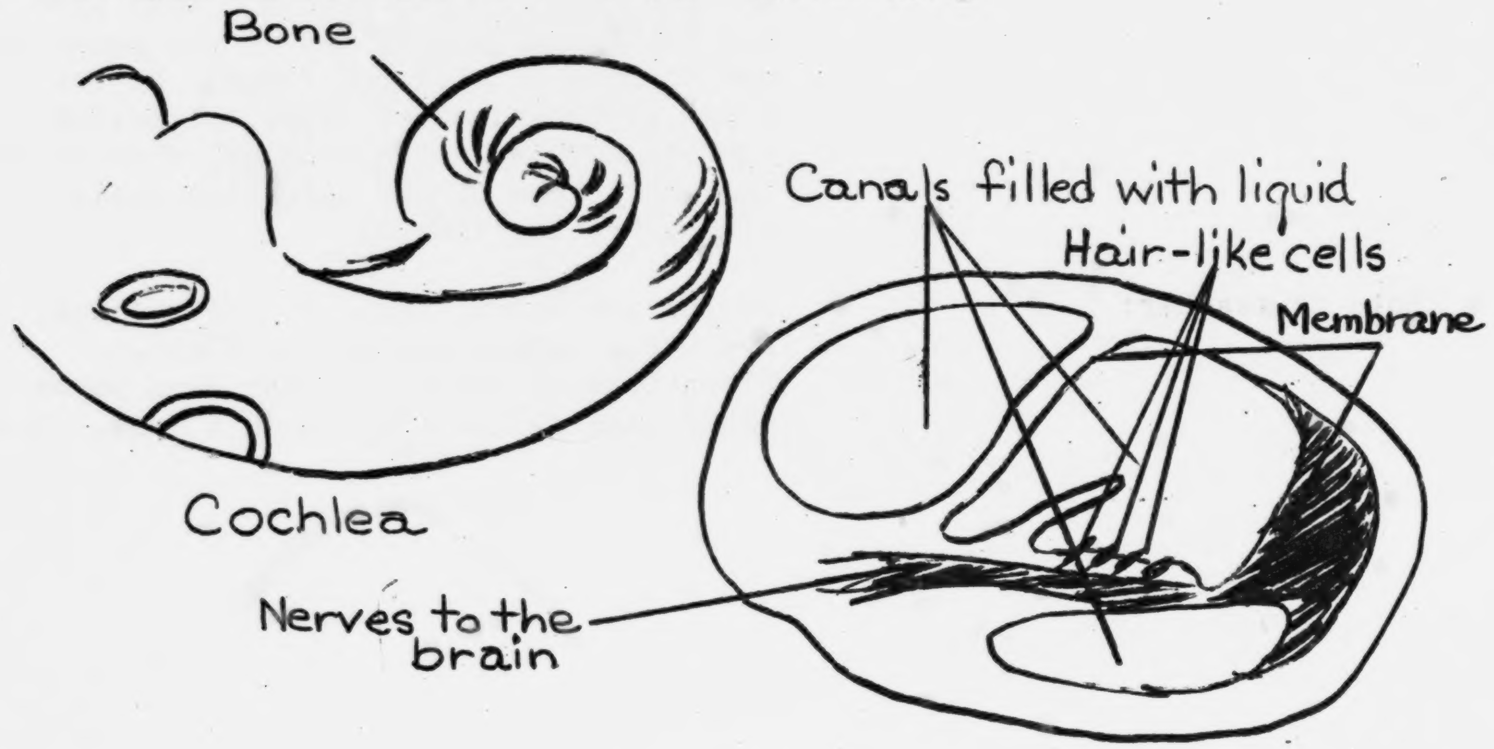
17. **Leading Question:** How are the canals separated in the cochlea?

Materials: An empty chocolate candy box with decorative paper separating the layers

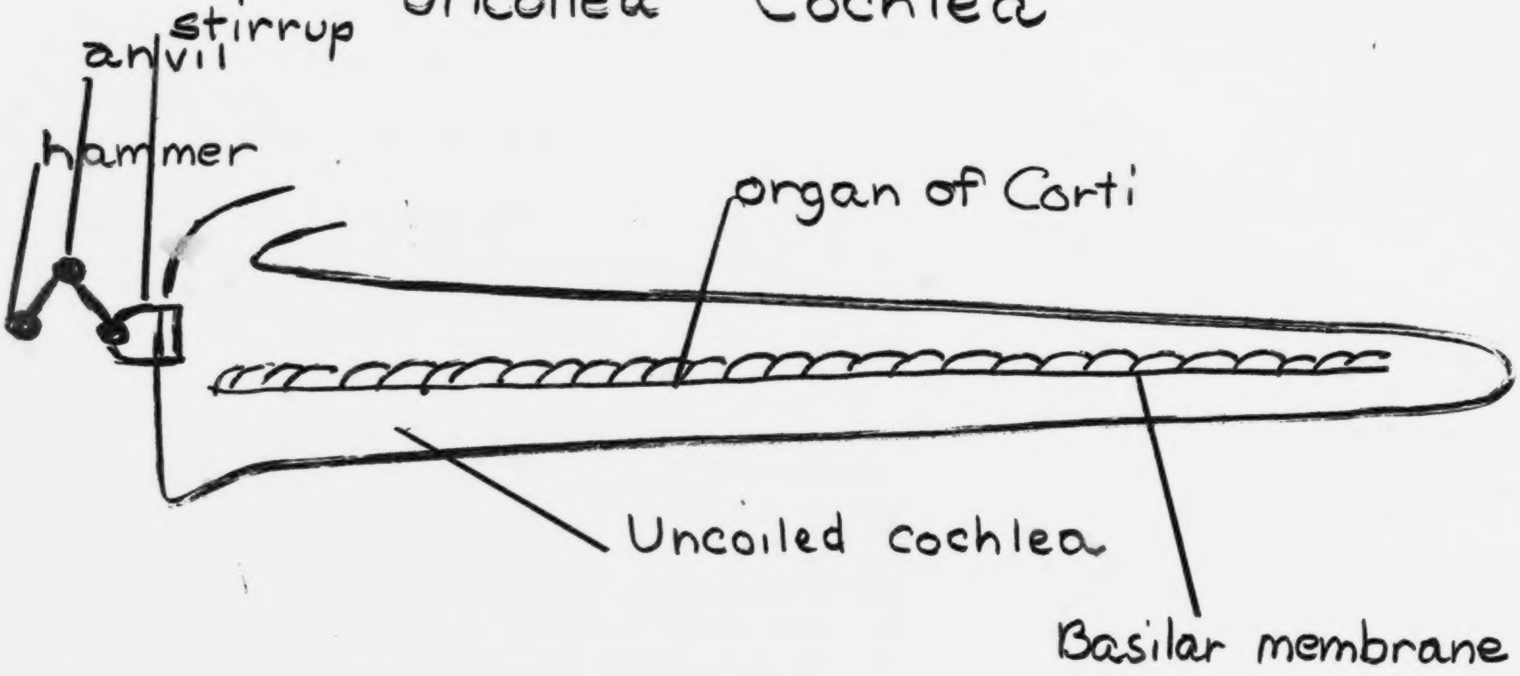
Procedure: Ask the children to bring in an empty chocolate box. Observe the decorative pieces of paper which separates the layers of candy in the box.

Draw a simple chart, on the chalkboard, of a cross-section of the cochlea. Ask the children to find the part of the box which represents the outer part of the cochlea. What do the papers between the layers of candy represent? Instead of candy what is found in the canals?

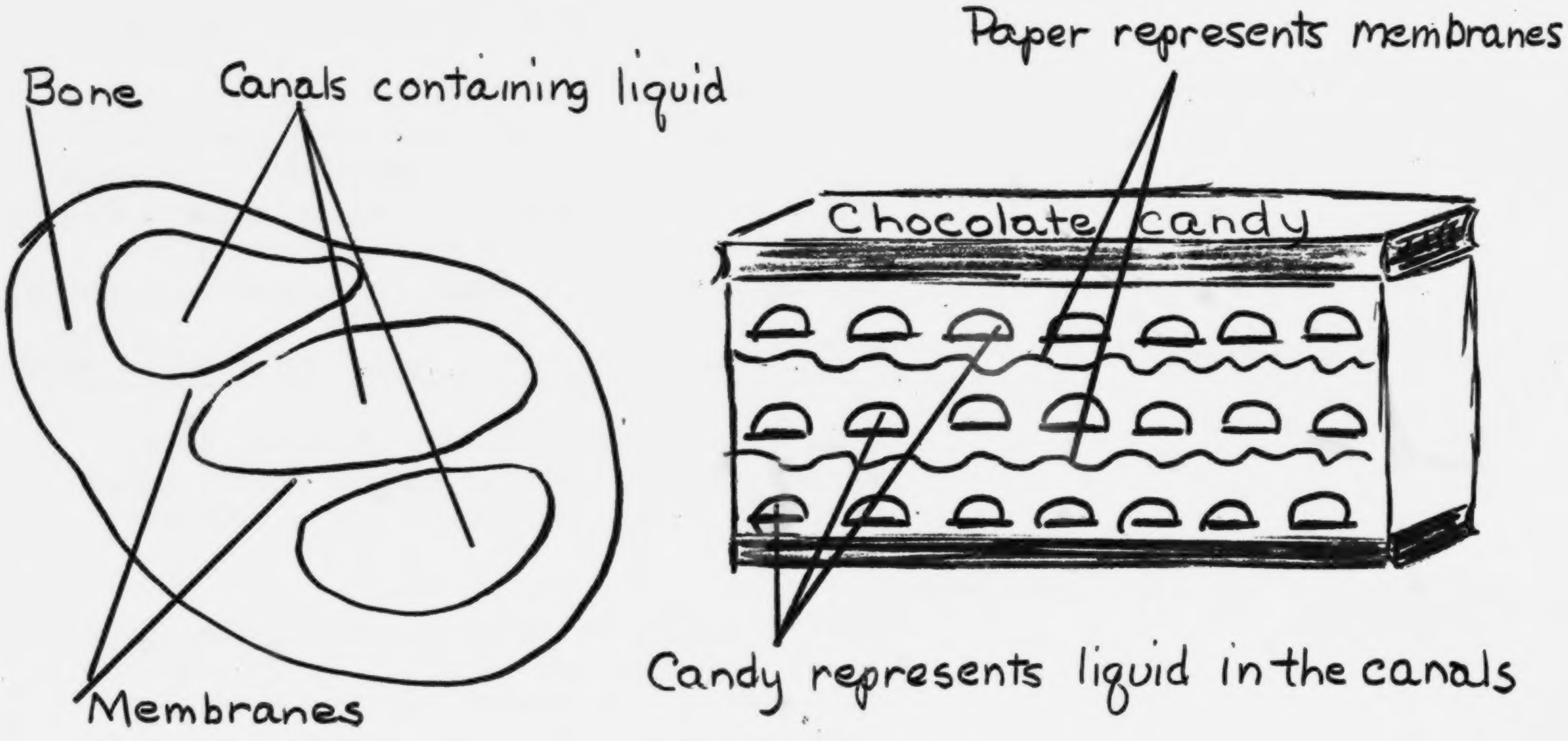
A. Cross section of the cochlea



Uncoiled Cochlea


stirrup
anvil
hammer
organ of Corti
Uncoiled cochlea
Basilar membrane

B. Canals in the Cochlea


Bone
Canals containing liquid
Membranes
Paper represents membranes
Chocolate candy
Candy represents liquid in the canals

Note to teacher: Along the spiral tunnels stretch a pair of membranes which separate the canals which contain liquid. In the experiment the membranes are represented by the dividing papers of the candy box. The liquid in the canals is represented by the layers of candy.

18. Leading Question: How can we compare the radio to the hearing area of the brain, and the electric cord, connected to it, with the auditory nerves?

Materials: Transistor radio

Procedure: Ask a child to bring a transistor radio to school. Tell him to open the back of the radio and examine the many tubes connected by wires. After examining the interior of the radio, replace the back. Ask the child to tell which part of the body he can liken to the inside of the radio. Now switch on the radio. What is heard? Why is music heard when the switch is on? What is used in a radio to cause vibrations? (batteries) What is used in a house radio to cause vibrations? (electricity) Which part of the body can we liken to the batteries or the electrical wire of the radio? (auditory nerves? Turn off the radio. Why can't the music be heard? What vibrates in the ears before vibrations travel to the brain?

Note to teacher: You might have the children conclude that the tubes in the radio are like the brain, since they convert the vibrations into something we can understand. Without the auditory nerves in the body or the electric wires of the radio there would be no recorded sound.

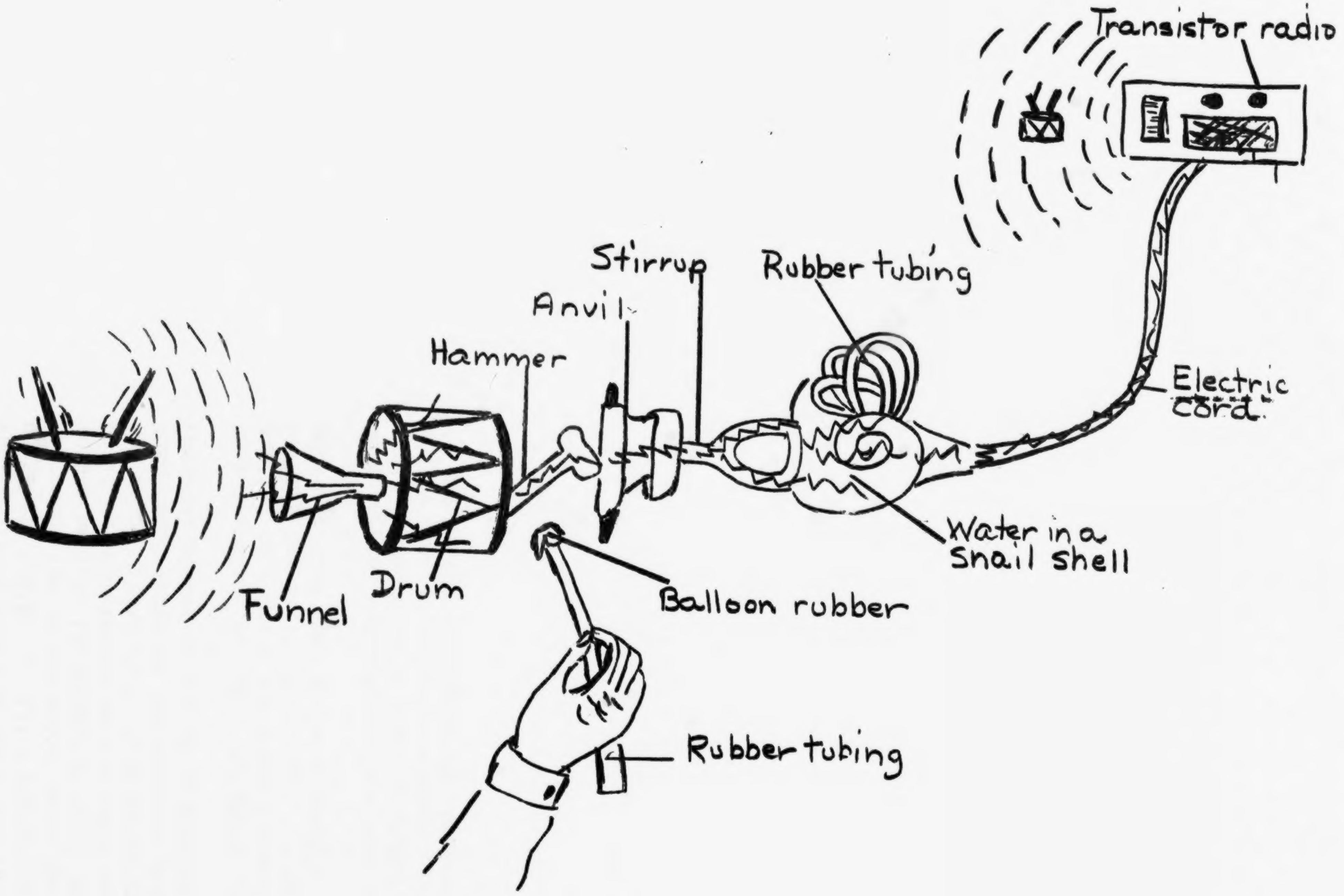
19. Leading Question: How can we construct a crude model of an ear?

Materials: Suggested by the children (funnel, drum, hammer, anvil, stirrup, snail shell, water, electric cord, transistor radio, rubber tubing,

Procedure: Ask the class to think about all the parts of the ear through which vibrations travel in order to understand the sound source that is heard. Have the children think about each part of the ear and what could be assembled to represent that part of the ear. What does the outer ear resemble? (funnel) Which things could be used for the middle ear? (hammer, anvil, stirrup) What shape does the inner ear have? (snail shell) What could be used for the fluid in the cochlea? (water or oil? How could we represent the nerves which carry the impulses to the brain? (an electric cord) What could be represented as the brain hearing the sound vibrations? (transistor radio) What could serve as the circular canals? (Several pieces of rubber or plastic tubing)

Have the class assemble the parts they have decided on. Trace the sound vibrations through the ear to the brain. (turn on the radio to show what is being heard)

Have several children perform some sound producing acts to be simultaneously acted out by another child to represent the sound in the brain. (Example: two drummers)


Transistor radio
Rubber tubing
Stirrup
Anvil
Hammer
Electric cord
Water in a Snail shell
Funnel
Drum
Balloon rubber
Rubber tubing

20. **Leading Question:** Besides hearing sounds, what other job does our ear perform for us?

A. Materials: Three-dimensional model of ear

Procedure:

Have each child stand on one foot and try to keep from falling over. Is it easy? Now try it with both eyes closed so you can't see what is happening. Can you stand on one foot without any difficulty? What feeling do you get? (swaying) There must be a sense to tell which way you are swaying so that you can check the direction before you fall. This is the sense of balance or equilibrium. It arises in three little canals that form part of the inner ear - the semi-circular canals near the cochlea.

Find the semi-circular canals on the three-dimensional model of the ear.

B. Materials: Small bowl, water, model of the ear

Procedure:

Pour some water into a small bowl. Hold the bowl very steady until the motion of the water dies down. Turn quickly to the right. What is happening to the water in the bowl? (It is spilling up a little on the left side of the bowl) The same thing is happening in the semi-circular canals of the ear as the body turns. Liquid in one of the canals is piling up against one side or the other.

Observe the model of the ear. Notice that the canals are arranged in three different directions, so that no matter which way the body turns or sways, at least one of the canals has its liquid set in motion. Nerve impulses make us aware of the motion.

C. Materials: A round screw-type piano stool, a blindfold

Procedure:

Blindfold a child and have him sit on a round screw-type piano stool. Have another child spin the stool around quickly. Stop the spinning stool suddenly. Ask the child which way he feels he is now turning. (He will feel that he is turning in the opposite direction because the liquid in the inner ear, which has been set spinning, continues its motion to give a sensation of spinning.)

D. Materials: None

Procedure: Have a child turn around and around several times. Stop suddenly. What feeling is caused by the sudden stop? (a dizzy feeling) What is happening in the semi-circular canal of the ear?

21. Leading Question: How can we emphasize the importance of our ears?

A. Materials: Film projector, film (any film available)

Procedure: Show a film to the class without the use of sound. Ask the children if they enjoyed the film without sound? Why?

Show the film again using sound. What was learned in the second showing which we were unable to learn without sound? What is the necessity of taking care of our ears so that we will never have to be without the important organ of hearing?

B. Materials: A short story or poem

Procedure: Read a short story or poem to the class without sound. Read the words with lip-movements. Did you understand the story? Is it necessary to hear the words?

Now read the story aloud. Did you enjoy the second reading? Can you imagine how much you would miss if something were to happen to our ears to prevent us from hearing?

22. Leading Question: What effect would a broken eardrum, have on the eardrum itself?

Materials: Two round oatmeal or salt boxes the same size, two drumsticks

Procedure: Use two equal-sized oatmeal boxes to represent eardrums. Puncture one lid to represent a punctured eardrum. Have a child tap the unpunctured drum and listen carefully. Have another child drum on the punctured drum and compare the sounds of both drums. How does each drum sound? Which makes the loudest sound? How can we compare the broken drum with a broken eardrum? What effect does a broken eardrum have on the hearing process? Why? Can a broken eardrum be replaced? Why? What important message does this experiment reveal to us?

List some things that should not be put into the ear for fear of puncturing the eardrum.

23. Leading Question: What are some possible causes of deafness? Will a hearing aid help in all cases?

Materials: Microphone

Procedure: Have the class discuss some possible causes of deafness. (A broken eardrum might be a cause. A bad ear infection could cause some deafness too. Some people are born deaf.)

How does a hearing aid work? After a discussion, examine and use a microphone to determine how it works and how it can be applied to a hearing aid.

Note to teacher: In some cases hearing aids can be useful. But if nerves are damaged, a hearing aid will not help. A hearing aid is simply a microphone connected to a speaker which is kept inside the person's ear. People who are truly deaf can never hear anything.

24. Leading Question: How would we feel if we were unable to have the use of our ears to hear what is going on around us?

Procedure: Have each child block out sound by cupping his hands tightly over his ears. Remain quiet for five minutes. How did you feel? What were you curious about? What did you miss? How long would you like to be unable to hear? Is it necessary to take care of our ears in order to have good hearing all our lives?

Note to teacher: For this experiment, make sure the child does not put anything in his ears.

25. Leading Question: How far can the doctor see into the ear with his otoscope?

Materials: Model of the ear, flashlight

Procedure: Have a child flash a flashlight into a model of an ear. How far can you see into the ear? Which part of the ear stops the light?

Shine a flashlight into a friend's ear. How far can you see? Can you see the eardrum? Why?

What do you think the doctor is looking for in the ear?

Note to teacher:

The farthest a doctor can see into the ear with his otoscope is the eardrum.

26. Leading Question:

If our outer ears act as funnels, how can we hear necessary sounds when they are not loud enough?

A. Materials:

Funnel, rubber tubing, Y-shaped tube

Procedure:

Ask a child to slip a piece of rubber tubing over the small end of a funnel. Put a Y-shaped tube into the other end of the rubber tubing. Fasten another piece of rubber tubing on each end of the Y-shaped tube.

Have a child run around the room several times so that his heart beats harder. Have another child hold the funnel over the runner's heart and have him hold the end of each piece of rubber tubing to his ears. Can the runner's heart be heard? Now listen without the apparatus. Can the heartbeat be heard clearly? Who may use an apparatus like this? What is it called? (Stethoscope)

What is the source of the vibrations? What is the conductor of the vibrations? What is used to make the vibrations louder? Why? What is the function of the funnel? What does the heartbeat sound like?

Note to teacher:

The stethoscope amplifies the sound by confining the sound waves within the tube and directing them to the doctor's ears.

B. Materials:

Wrist watch, large piece of paper

Procedure:

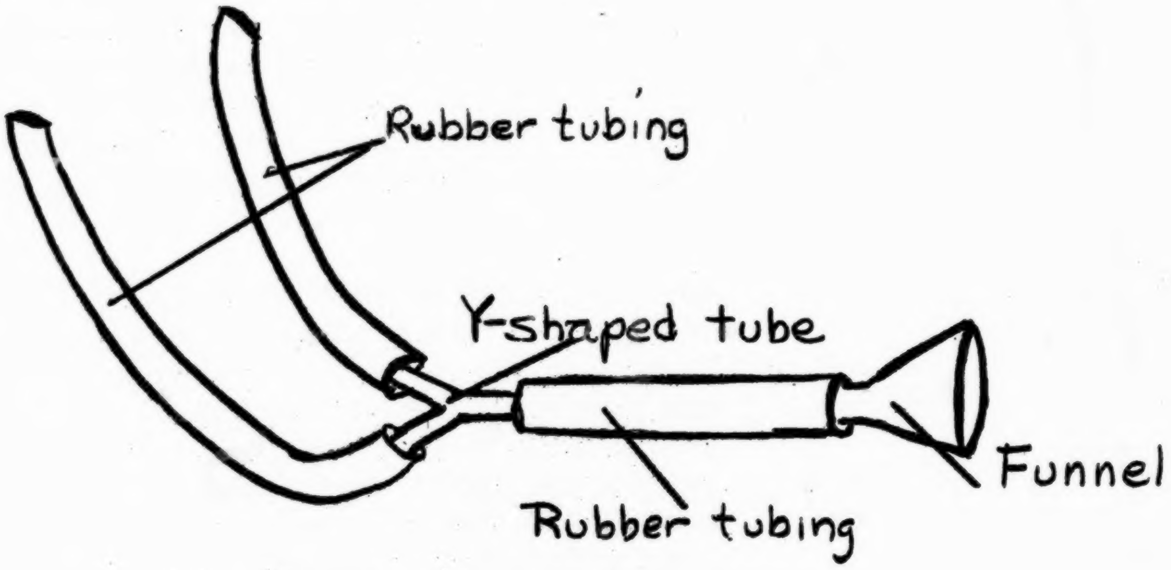
Tell a child to roll a large piece of paper into a tube. Place one end of the roll against a wrist watch. Listen into the other end of the tube. Can the ticking of the watch be heard? Why?

Listen to the watch from the same distance without the roll of paper. Can the ticking of the watch be heard? Why?

C. **Materials:** None

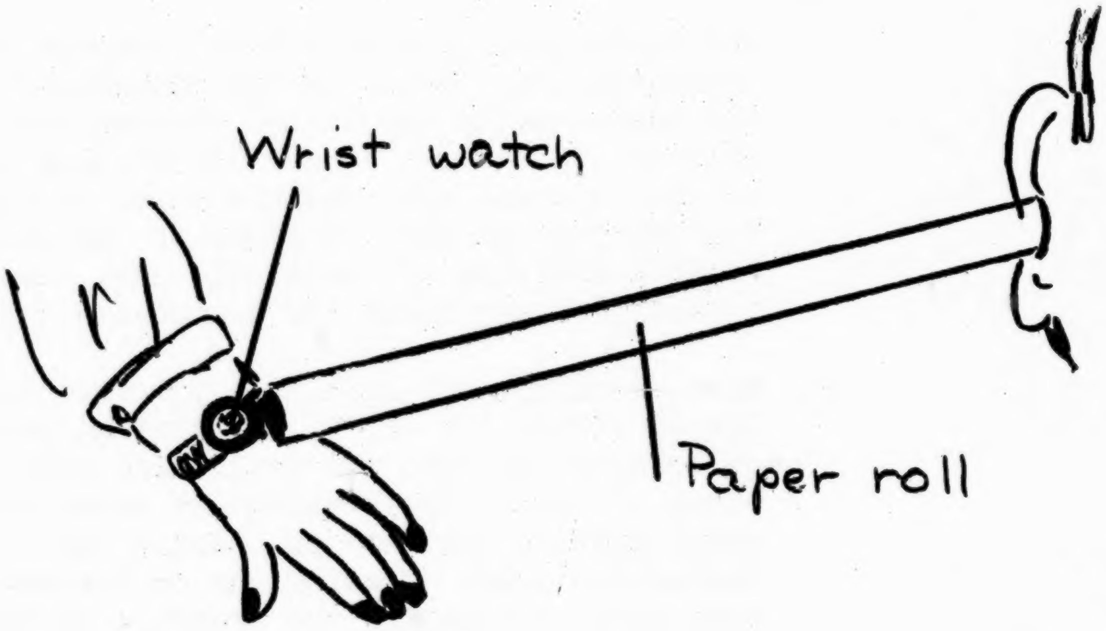
Procedure: Collect and study pictures of other devices which help us to hear sounds more clearly. (hearing aid, stethoscope, sound movies, microphone, radio, tape recorder, radar, telephone, record player, telegraph, television)

A.


Rubber tubing
Y-shaped tube
Funnel
Rubber tubing

Stethoscope

B.


Wrist watch
Paper roll

27. Leading Question: What is the job of the Eustachian tube?

Materials: Rubber tubing, balloon rubber, rubber band

Procedure:

Stretch a piece of balloon rubber over the end of a piece of rubber tubing. Fasten the balloon rubber securely with a rubber band. (The balloon rubber stretched across the end of the tube represents the eardrum. The rubber tube represents the Eustachian tube.) Press on the middle of the tube with the thumb and index finger in order to close the tube. (This represents the small muscles that aid in opening and closing the Eustachian tube.)

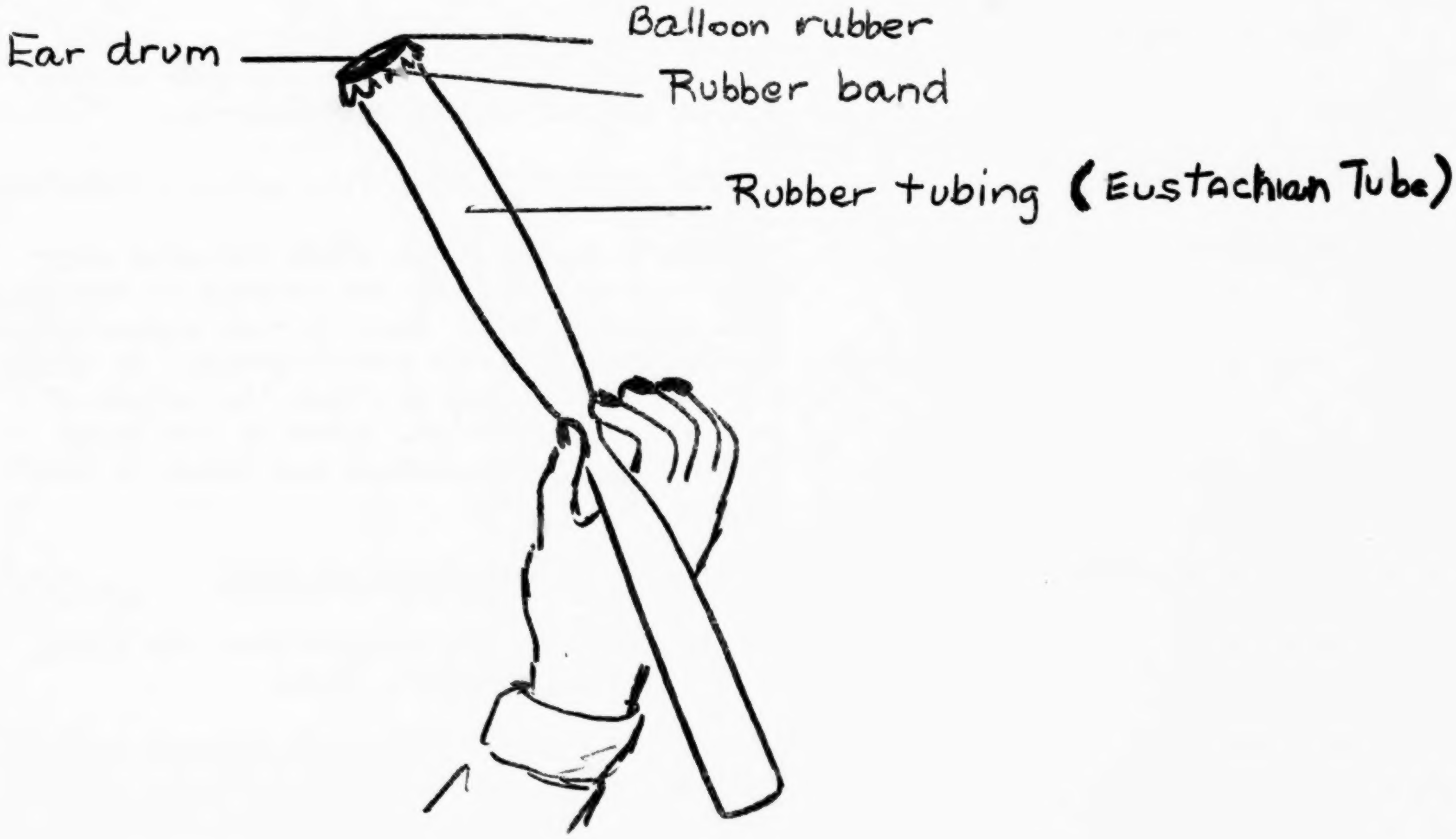
Ask the children what they think the tube represents. What does the balloon rubber represent at the end of the tube? What does the pressure of the fingers on the tube represent? What happens in the tube when a person swallows? What presses against the outside of the balloon rubber? What kind of a feeling would a person have in his ear if the air pressure were greater on one side of the eardrum? What would happen to the stretched rubber if there wasn't enough air pressure on the inside of the rubber? How can we apply this information to the eardrum?

Blow against the outside of the balloon rubber. What happens to the rubber? Blow into the end of the tube? Have another child watch what happens to the rubber. Why does the balloon rubber push out or in?

Note to teacher:

The Eustachian tube is a small passageway connecting the cavity of the middle ear with the nasal cavity and serves to keep the air pressure in the middle ear essentially equal to the external air pressure so as to equalize the pressure on the two sides of the eardrum. Painful swelling of the middle ear, due to infections, may block the Eustachian tube.

When traveling by plane, the pressure is relieved within the ear by swallowing, yawning, or holding the nose and swallowing with the mouth closed. These maneuvers tense the small muscles that aid in opening the Eustachian tube. Chewing gum on descent may also help to equalize the pressure in the ears.



28. **Leading Question:** How does the inner ear protect itself from dirt and insects?

A. Materials: Spiral fly paper, microscope, magnifying glass, encyclopedia

Procedure: Hang a spiral fly paper in the doorway of the classroom. Observe what happens to the fly paper over a period of several days. Allow the children to make observations. What happens when a fly settles on the paper? Why? Examine the paper with a microscope or magnifying glass. What can be seen on the paper besides flies? (dirt and dust) Why does the dirt and dust stick to the paper? To which part of the ear can the sticky fly paper be likened? (sound canal leading to the eardrum.) What can be found in the sound canal that acts as the sticky part of the fly paper? (wax). Besides wax, which other parts in the canal help to keep out some dirt and insects? (small hairs) Search for information in the encyclopedia to back up the suppositions.

Note to teacher: The material on the fly paper has an odor which attracts flies while the odor of the wax in the ear repels most insects.

B. Materials: Cactus plant with many fine spines, encyclopedia

Procedure: Observe a cactus plant which contains many fine spines. What is the purpose of the spines on a cactus plant? Back up your suppositions by checking with the encyclopedia. To which part of the ear can we liken the spines of the cactus plant? (the hairs in the sound canal.) What purpose can the hairs in the sound canal serve?

29. Leading Question: Where are the ears of a cricket?

Materials: Magnifying glass, a cricket from the field, encyclopedia or science books

Procedure: Have the children locate information about the cricket in special science books or the encyclopedia. Ask the children to find a live cricket in a field and to bring it into the classroom. Use a magnifying glass to find the cricket's ears. Where are the ears of the cricket? Are they at the usual place we expect them to be found? (It is a small white spot just below the elbow of the cricket's front leg)

30. Leading Question: Since snakes have no external ears, how do they hear?

Materials: Terrarium, live garden snake or water snake, book on snakes

Procedure: We sometimes hear or read about Indian snake charmers. The snake seems to follow and move to the sound of the flute. Does the snake really hear the music of the flute?

Have a snake lover, in the class, find a garden or water snake. Have him place it in a terranium in the classroom. Place a screen over the terrarium to prevent the snake from escaping. Over a period of several weeks, try many times to interest the snake in a special sound. (a whistle, flute) Blow the whistle from different positions above, below, front, side and rear. Keep a record of what the snake does when the whistle is blown near it.

Sometimes go through the process of blowing the whistle without producing sound. From time to time report to the class the findings. If the experiment does not seem to answer the questions, then read to find out about the hearing of snakes. Experiment again to see if we can determine how they know when a person is approaching them in the woods or fields.

Note to teacher:

Although snakes have no external ears, they are sensitive to vibrations from the ground.

31. Leading Question:

What means of communication do ants use?

Materials:

Gallon jar, loose soil from an anthill, ants and pupae from an anthill, pan, piece of sponge, ant food (bits of apple, cake, bread), piece of dark paper

Procedure:

Ask the children to try to find an anthill or to search under stones to find a colony of ants. Make sure the child replaces the stone over the ants so that the ants will not be frightened away before he returns to get them.

To prepare an ant observation house, find a screw-top gallon glass jar. Fill the gallon jar nearly full with loose, moist soil from the anthill or from under the rock. Place some ants and pupae in the jar. Find the queen ant which is much larger than the other ants. Put the ants in the jar. Place the jar in a shallow pan of water to prevent the ants from escaping. Hang a piece of wet sponge over the top edge of the jar for the ants to drink water. Feed the ants with tiny bits of cake, bread, or apple. Wrap the jar in dark paper and place it in a dark closet for several days. When the ants are not being observed keep them in a dark place. After several days take the jar from the closet and remove the paper. Observe the ants. Make many attempts to attract them with sound. Do you think they hear vibrations or do they feel them? Can you find their ears? Keep a record of your observations.

When the ant colony has been studied for several weeks make your conclusions. If the class is still not satisfied, find some books about ants in the library and read to find if you have come to the correct conclusions.

Note to teacher:

Ants do not hear the way we do, but they are very sensitive to vibrations in the earth and nest. The organs that perceive vibrations are located on the third leg joint, the thorax, and the head.

ACTIVITIES TO ASSIGN FOR HOMEWORK OR INDIVIDUAL RESEARCH

32. Leading Question: Are all ears alike? Are all ears found on the head?

A. Materials: Science books, encyclopedia

Procedure: Search for these answers in science books or the encyclopedia. Read to find:

How do most mammals hear?
How do birds hear?
How do insects hear?
How do bats hear?
How do toads hear?
Do turtles have ears? Is it true that they are deaf?
Do snakes have ears?
On which part of the body does the grasshopper have its hearing part?
Why does the rabbit have long ears?
How do big ears help a mouse?

B. Materials: None

Procedure: After different members of the class have reported their findings on kinds of ears, have the members of the class make up riddles to test their knowledge of kinds of ears or hearing parts of animals.

Example: This animal has 6 legs. Its ears are located on the front legs. It has eardrums but no outer ears. What animal is it? (Cricket)

33. Leading Question: If a tree falls in the forest, and no one is present to hear, is sound produced?

Procedure: Discuss among your friends an old saying, "If a tree falls in the forest, and no one hears it, there is no sound." What is missing?

Note to teacher: Remember that in order to hear, four things are necessary; a vibrating body, a conductor of sound, ears to receive sound waves, and the brain.

34. Leading Question: Are outer ears of greater service for animals than for man?

Materials: Multi-Text Science Books, encyclopedia

Procedure: Encourage the children to investigate many science books or the encyclopedia to find out about the purpose of different sizes of outer ears for different animals.

35. Leading Question: How do the semicircular canals help us to keep our balance?

Materials: Three glasses of water, chart of the inner ear

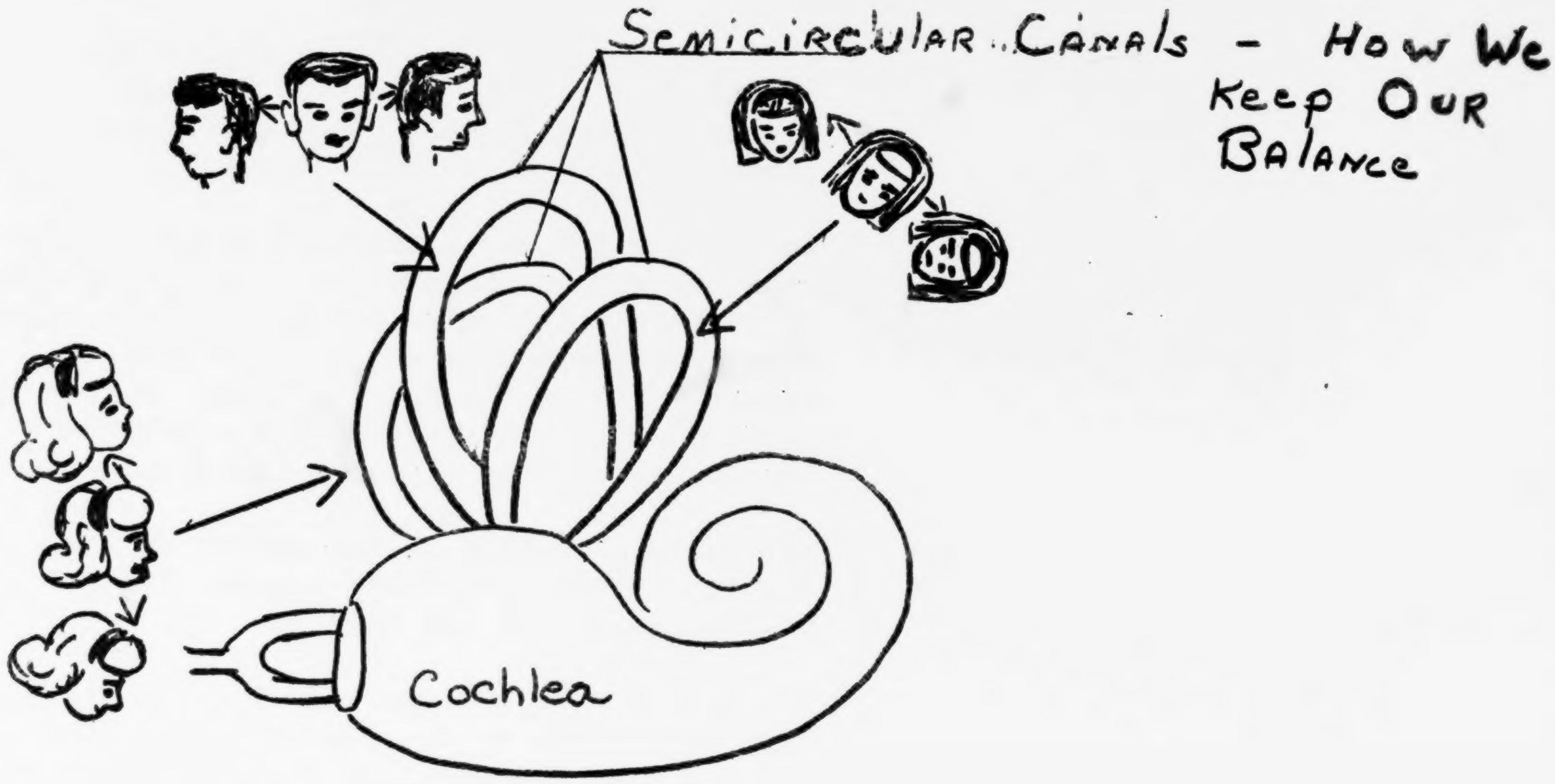
Procedure: Have the children fill three glasses with water. Stand the three glasses in a row on a table. Tip the right hand glass to the right. Place a small object under the tilted glass. Keep the middle glass standing on the table. Tip the left hand glass to the left. Place an object under the glass to keep it tilted. Observe the movement of the water in the glass as it is moved. Relate this movement of the water in the glasses with the movement of the fluid in the semicircular canals.

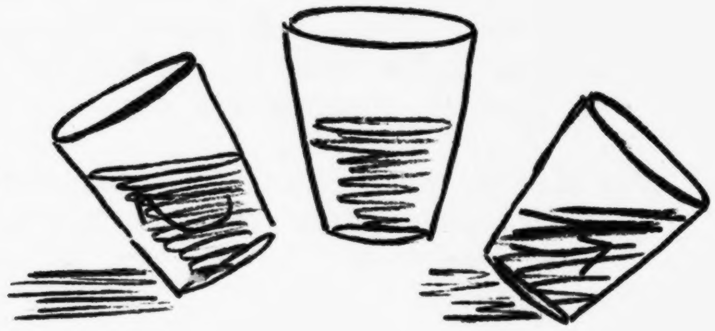
Think of some of the times when you have had trouble with your balance. (Seasickness and dizziness produced by swinging or turning around rapidly result from excessive stimulation of the semicircular canals in one direction)

Note to teacher: The semicircular canals do not help us to hear. They are concerned with our sense of balance. Each canal detects balance in a different direction.

Nerves carry messages from the canals to the brain, which relays the messages to the muscles we use to keep our balance. The brain sends "messages" to the various muscles of the neck, trunk, and limbs that maintain the balance of the body.

Dizziness and trouble with balance occur when the semicircular canals are diseased.


Semicircular Canals - How We Keep Our Balance
Cochlea



36. Leading Question: How can I build an artificial ear? How can I show how the vibrations of the eardrum, ossicles and cochlea work?

A. Materials: Mailing tube, paper plate, rubber bands, wood, nails, paper cup, water, radio, thumb tacks, string, dowel, button

Procedure: Have the children bring in the materials listed. Cut a mailing tube in half.

With the help of an older brother or father, construct a rack to place the mailing tube firmly in place. Nail the two V-shaped pieces of wood on a small board.

Cut a hole in the center of a paper plate. Tape the end of the mailing tube to the plate to represent the outer ear and the ear canal. Stretch a piece of tracing paper over the opposite end of the mailing tube. Fasten the paper with a rubber band. The stretched tracing paper represents the eardrum.

Tape a large button to the center of the tightly stretched tracing paper. The button represents the hammer.

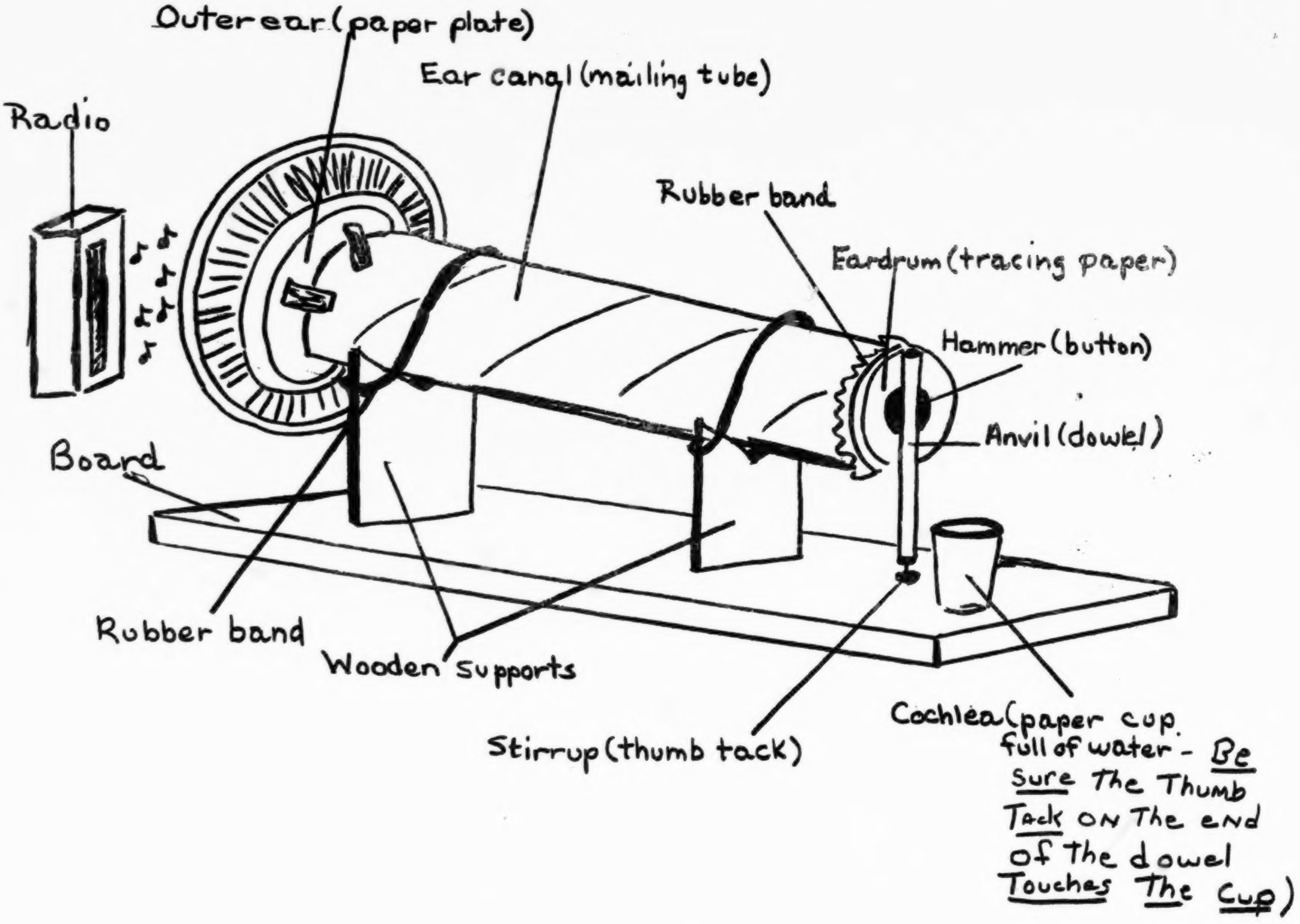
Tie a string around the end of a dowel stick. Tape the string to the top of the mailing tube so that the dowel can hang in front of the button. The dowel represents the anvil. Press the point of a thumb tack into the opposite end of the dowel to represent the stirrup.

Use a paper cup filled with water for the cochlea. Place the paper cup close enough to the thumb tack on the end of the dowel so that it touches the cup.

Place a radio near the outer ear. Sound vibrations coming through the tube should cause the water in the cup to break into ripples.

Note to teacher:

It may be necessary to insert a cone-shaped paper funnel into the tube leading to the eardrum to cause greater vibration of the stretched paper.


Outer ear (paper plate)
Ear canal (mailing tube)
Radio
Rubber band
Eardrum (tracing paper)
Hammer (button)
Anvil (dowel)
Board
Rubber band
Wooden supports
Stirrup (thumb tack)
Cochlea (paper cup full of water - Be sure the thumb tack on the end of the dowel touches the cup)

B. Materials:	Use model A, mailing tube, tracing paper, rubber band
Procedure:	Use model A with the exception of the paper cup. Cover one end of another mailing tube with tracing paper. Stretch tightly and fasten with a rubber band. Lay the mailing tube on the table close to the dowel. Listen to the radio through the open end of the tube. The sound vibrations should cause the thumb tack, on the end of the dowel to vibrate against the tightly stretched paper.

HUMAN BODY

GRADE 4

HUMAN BODY

Body Structure **Grade 4**

Cells

UNDERSTANDINGS TO BE DISCOVERED	**RELATED ACTIVITIES**
The human body is composed of tiny structured units called cells which are of various shapes and sizes.	1, 2
Cells have three main parts: the nucleus, the protoplasm, and the cell membrane.	1, 2, 3
Each cell performs a specific function for the body.	2
Tissues are groups of cells which are organized to perform certain body functions.	19
Various types of specialized tissue are present in the body.	19
Organs are groups of tissues working together.	19
Systems are groups of organs working together.	19
Cells are composed of similar materials: carbon, oxygen, hydrogen, nitrogen, and tiny amounts of other substances.	2, 3
Cells receive nourishment and eliminate waste materials through a process called osmosis.	3
Cells present in the body are encased in a salty liquid called lymph.	2, 3
When cells are injured, they can be repaired or replaced by new cells (mitosis).	4, 9
Some micro-organisms are harmful to the body while others are beneficial.	7, 8, 14
Bacteria and viruses are types of micro-organisms.	5, 6, 7
Bacteria have three basic forms: coccus (round); bacillus (rod-shaped); and spirochetes (spiral).	3, 5, 6, 7, 14, 15
Viruses are the smallest form of bacteria.	5, 7
Immunization can give protection against certain harmful bacteria	7

HUMAN BODY

Body Structure

Grade 4

Skin

UNDERSTANDINGS TO BE DISCOVERED	RELATED ACTIVITIES
The skin is the sensitive, protective covering of the body which is composed of millions of tiny cells.	1, 2, 10, 11, 18
The exterior layer of the skin is called the epidermis which consists of dead cells.	10, 11, 16, 18
Dead cells are rubbed-off through bodily actions and are then replaced.	4, 17, 18
The interior layer of the skin is called the dermis which contains the sweat and oil glands, the blood vessels, and the nerve endings.	12, 13, 16
Skin grows at different thicknesses on the body.	11, 16
Pigment is the substance which determines skin color.	20
Pores are tiny openings in the skin which aid in controlling body temperature.	13
Sweat glands aid in eliminating liquid wastes from the body.	13
Oil glands secrete oil to lubricate the skin.	12, 17, 18
Burns and sunburns occur when part of the layers of the skin are subjected to excessive heat or overexposed to the sun's rays.	18
Proper diet, rest, exercise, and cleaning help maintain healthy skin.	14, 15

Body Structure

Grade 4

Muscles

UNDERSTANDINGS TO BE DISCOVERED	RELATED ACTIVITIES
The body is dependent on muscles for any type of movement.	23, 25, 26, 28, 29
Animals move in certain ways because of their muscular and skeletal structure.	33, 34, 43
Nerve impulses activate muscles.	22
Muscle tissue is composed of fibers that are strong and elastic.	21, 32
Muscles work in pairs.	23, 24, 25, 29
There are three types of muscles in the body.	21, 24
Different types of muscles perform various functions.	21, 24, 26, 27
Muscles are essential to body functions.	29
Voluntary muscles can be consciously controlled.	22, 24, 26, 27
Involuntary muscles work without the aid of conscious control.	22, 28
Muscles are developed through usage.	30
Muscle tone is lost when muscles become fatigued or are weakened by injury or disease.	26, 31
The body can, and does, repair muscle tissue.	
Strains occur when muscles are stretched beyond capacity.	26
Tendons connect muscles to bones, while ligaments connect bones to other bones.	21, 41, 45

HUMAN BODY

Body Structure

Grade 4

Skeleton

UNDERSTANDINGS TO BE DISCOVERED	RELATED ACTIVITIES
The skeleton is the framework of the body which shapes, supports, and protects the body.	35, 36, 37, 39, 40, 44, 46
The skeleton is jointed to enable the body freedom of movement.	34, 35, 43, 44, 47
Joints fulfill different functions and have various structures.	34, 47
Dislocations occur when joints are dislodged.	34, 47
Sprains occur when the ligaments surrounding joints are injured.	
Joints are self-lubricating.	
Man has a jointed thumb which works in opposition to the other fingers.	42
Calcium and phosphorus strengthen the supportive power of the skeleton.	38
Vitamin and mineral deficiencies, affect the skeleton.	38
Before bones harden (ossify), they are called cartilage.	38
The marrow contains the blood vessels and nerves.	48
Bones grow at different rates and determine various body proportions.	35, 36, 40, 46, 49
Bones can, and do, repair themselves after proper medical treatment.	
The spinal column is the primary factor in maintaining body erectness.	35, 37
Correct posture is essential for proper body functioning.	37

ACTIVITIES

1. Leading Question: What do body cells look like?

Materials: Toothpicks, iodine, glass slides and cover slips, microscope

A. Procedure: Working in committees, have one child in each group gently rub with the flat end of the toothpick the inside of their cheek. Place the scrapings on a slide and add a tiny drop of iodine. Cover the slide and place it under the microscope. What appears? Do cells vary in structure with the various class members?

B. Procedure: Repeat activity using scrapings from the scalp.

C. Procedure: Repeat activity using dry skin scales.

Compare the results. What cells appear different? Why?

EXTENDED STUDY: The better students may be able to do drawings of the cells as seen through the microscope.

2. Leading Question: What are the main parts of a cell?

Materials: Microscope, slide and cover, staining solution (iodine), onion

Procedure: Have the children take a slice of onion and divide the layers. Attached to each layer is a thin tissue layer. Have them carefully remove this layer and place it carefully on a slide. Next, place a drop of staining solution on the slide, cover it, and place it under the microscope. Discuss what can be seen? Can the three main parts be identified? What are their functions?

Note to teacher: To vary the activity, have the children try a piece of green leaf to see if the cells are different in any way?

This would be a good opportunity to utilize the drawings made under Understandings #1. The drawings could be labeled such as nucleus, protoplasm, etc.

3. Leading Question: How do cells receive nourishment?

Materials: Box of clear geletin, some starch, cologne, plastic sandwich bag, string, small piece of clay, iodine, jars

Procedure: The children will first have to make, or the teacher prior to the lesson can make, the cell itself. This can be done by boiling one cup of water and then adding the gelatin. Add one-half a cup more of cold water, a teaspoonful of starch, and a teaspoonful of cologne. Stir the entire mixture and place a small amount in the plastic bag. Add a tiny ball of clay to serve as the cell nucleus. Tie the bag securely so that its appearance is basically round. Compare the materials in a cell.

Have the children place their bags in jars, filled about three-quarters full with warm water. Put iodine in one jar and clear water in the other jar. What happens in the two jars? Why?

Note to teacher: In the iodine solution, the iodine will diffuse through the bag and will turn the starch solution blue, whereas in the clear solution, the perfume will have diffused into the water. The children will be able to detect this by smelling the solution.

4. Leading Question: How fast do bacteria spread?

Materials: None

Procedure: After discusssing and experimenting with cell division, see if the children are able to complete the following table. One complete division requires about 20 minutes.

Time	No. of Bacteria
0 min.	1
20 min.	2
40 min.	4
1 hour	8
1 hour 20 minutes	16
1 hour 40 minutes	32
2 hours	
12 hours	
1 day	

5. **Leading Question:** How large can a colony of bacteria become?

Materials: Sterile agar of beef solution, covered Petri dish or jar (agar-agar can be obtained from Science Helping Teacher)

Procedure: Have the children place some sterile agar in either of the above containers. Leave the jars open for a few minutes and then close them tightly. What happens after a few days? Have the children keep a record of how many colonies appear each day. Are there more colonies at the end of the week or have the few original merely spread? Are they the same colors? Compare the shapes.

Note to teacher: To vary the experiment, try exposing a few jars to the air for a few minutes and then expose the jars to different physical conditions. Have the children record what happens in each jar and then compare results.

6. Leading Question: How do bacteria spread disease?

Materials: Three oranges, one of which is mildewed, sterilized needles

Procedure: Puncture the moldy part of a mildewed orange. Using the same needle, inject it into one of the fresh oranges. With another sterilized needle, puncture the third orange. Compare the two oranges after a few days. What has happened? Why?

Note to teacher: About a week prior to this experiment, place an orange in the sunlight. This will cause mildew to form which is necessary to the above experiment.

7. Leading Question: Why must bacteria be isolated?

Materials: Cotton swabs, covered Petri dishes filled with agar or beef solution

Procedure: Wet a sterile cotton swab slightly and bring it in contact with the top of a colony of bacteria. (Perhaps one from the toothpaste experiment). With this sample, make a zig zag streak across the top of the sterile agar. Have the children observe closely for a few days. Is the colony the same as the one from which the sample was taken? Why?

Note to teacher: A pure culture will develop. Doctors use this method to isolate the causes of certain diseases.

8. Leading Question: Which toothpaste prevents more cavities?

Materials: Different brands of toothpaste, five or six Petri dishes with either agar solution or beef solution

Procedure: After exposing the Petri dishes to the air for 30 minutes, have the children place small amounts of the different toothpastes in each dish. What happens after a few days? Why? Compare results.

Note to teacher: To vary the experiment, have the children scrape some material from between their teeth and then scratch it into the agar. Add toothpaste and close tightly. Try this with several brands. Place the dishes in a warm, dark place for a week. Compare and discuss the outcome.

9. Leading Question: Does water aid in the growth of bacteria?

Materials: Powdered milk, two glass jars

Procedure: Have each committee place half of the powdered milk in one jar and add water. In the other jar, place the second half of the powdered milk. Seal both jars and place them on a windowsill for a few days. Do they have the same odor? Why or why not?

Note to teacher: The removal of the water effect the growth of the bacteria.

10. Leading Question: How is the skin like a signal system?

Materials: Large brass paper fasteners, blindfolds

Procedure: Have the children select partners. One partner should spread the ends of the fastener about a half an inch apart, while the other child is being blindfolded. Working first on the back of the hand, have the partner touch with either one end or both ends of the fastener while the other child tells how many prongs are felt. Why can only one be felt even though two may be making contact?

Now try touching the fastener on other body areas such as the palm of the hand, fingertips, forehead, tip of nose, and the upper and lower arms. Where can only one be felt even if there are two? Why? (Skin is less sensitive in some areas because only one nerve will be contacted).

Note to teacher: To vary the entire activity, have the children try changing the distance between the ends of the fastener, increasing it a little after each trial. Children can keep a record on a table similar to the following one.

Area of Skin Contacted	Distance Between the two Points
Palm of Hand	
Back of Hand	
Nose	
Forehead	
Fingertips	
Leg	

11.	Leading Question:	How thick is skin?
	Materials:	Salt, sheets of oaktag, cornflakes
	A. Procedure:	Sprinkle grains of salt on to the sheet of oaktag and then have the children gently touch it with the inside of their wrists. How does it feel? Now have them touch it gently with their fingertips. Which way can the grains of salt be felt best? Why?
	B. Procedure:	Repeat the above experiment using crushed cornflakes. Discuss why the cornflakes can be felt easier than the salt.
12.	Leading Question:	How is the skin lubricated?
	Materials:	Eye droppers, water, baby oil, vaseline
	Procedure:	Let the children place tiny drops of water on the backs of their hands. What happens? Why? Now have the children cleanse their hands with soap and try the same procedure immediately. What happens? Why? How is oil useful to the skin? What might happen if the skin did not have sufficient oil?
	Note to teacher:	Repeat this experiment by placing tiny drops of water on the backs of hands that have been rubbed with baby oil or vaseline. What happens? Why do long distant swimmers thoroughly cake their bodies with grease before attempting to swim hours and hours? How does the oil on a duck's feathers provide protection for that duck?

13. **Leading Question:** How is the body air-conditioned?

Materials: Ink, magnifying glasses, eye droppers, blotting paper

Procedure: Allow the children to place small drops of ink on the palms of their hands. Have them then look at the spot under a magnifying glass. What are the small pits called? What job do they perform? Why?

On an extremely hot afternoon, direct the children in some vigorous activity. Give the children pieces of blotter and let them blot their foreheads. What happens? Why?

How can this be related to an air-conditioner?

14. **Leading Question:** Why bother to wash?

Materials: Mixture of beef solution or prepared agar placed in several Petri dishes

Procedure: Prepare the Petri dishes. Have one child touch a spot of the solution. Before touching the next dish, have the child rinse the hand with water. For the third dish, have the child wash with soap and water before touching the solution. Observe the dishes for a few days. Why is there less bacteria in one dish?

Note to teacher: To vary the activity, have one of the children rub a swab over his teeth and then streak the solution with the swab. Now have him brush his teeth and take another sample. What happens in the dishes after a few days? Why? Try using other areas of the body, e.g. nose, elbow, and fingernails. Are the bacteria the same?

15. **Leading Question:** How do bacteria spread?

Materials: Covered Petri dishes, agar, cotton swabs

Procedure: Permit the children to rub clean, moist swabs over various objects they touch, (e.g. a book or doorknob). Then have them rub each swab over the agar--one swab for each dish. Watch what happens. Which object was the most unclean? Why? Are all the bacteria the same? Why or why not? Compare and record the data.

Note to teacher: If prepared agar is not readily available, the following can be utilized:

One-half pint rich beef broth
One quart of liquid gelatin
One pinch salt
One pinch baking soda

Prepare the gelatin according to the package. Add the beef broth, salt, and baking soda. Boil four jars for one hour. While the gelatin is hot, pour it into the sterilized jars. Cap tightly.

16. Leading Question: How deep does skin go?

Materials: Related charts and visuals from the Instructional Materials Center

Procedure: Discuss and observe the various layers of the skin. Compare the functions of each part. A scar on a child's arm or leg can lead to a deeper concept of skin.

17. Leading Question: Why does the skin need oil?

Materials: None

Procedure: Discuss what happens when hands are in a dishpan for a long time. Why? Can this be compared to what happens in the winter to the lips? Why or why not? What happens if something is put onto the lips?

18. Leading Question: What happens when you're sunburned?

Materials: Sun lamp, lettuce, wet blotter paper

Procedure: Discuss the effects of the summer sun on the skin. Why are lotions applied before and after exposure to the sun?

Expose the lettuce leaves and wet blotter paper to the rays of the sun lamp. What happens to the moisture in the lettuce? Why does the blotter dry up? How does this pertain to our skin?

19. Leading Question: How do cells work together?

Materials: Related charts and visuals from the Instructional Materials Center

Procedure: Through the use of visuals, discuss the differences between tissues, organs and systems. How does one system depend upon the other?

EXTENDED STUDY: Borrow a "Turn-a Gear" from a kindergarten teacher or gear transparency from the Audio Visual Aids Center. Label each gear as a tissue, organ, system, etc. As one gear turns, all gears turn. This can be related to the concept of how all individual parts work together for the whole.

20. Leading Question: Does the body contain a coloring material?

Materials: Celery, food coloring, ink, glass

Procedure: Place the celery in a glass of colored water or ink. What happens to the celery after a few days? Why? Can this be compared to the human body? Why do some people have darker skin tone and hair color than others? What is this coloring material called?

21. Leading Question: Where are muscles located in the body?

Materials: Model of human body from Science Materials Center

Procedure: Model should be available in the room for the children to work with as the unit is studied. Have them note the various differences in muscle tissue.

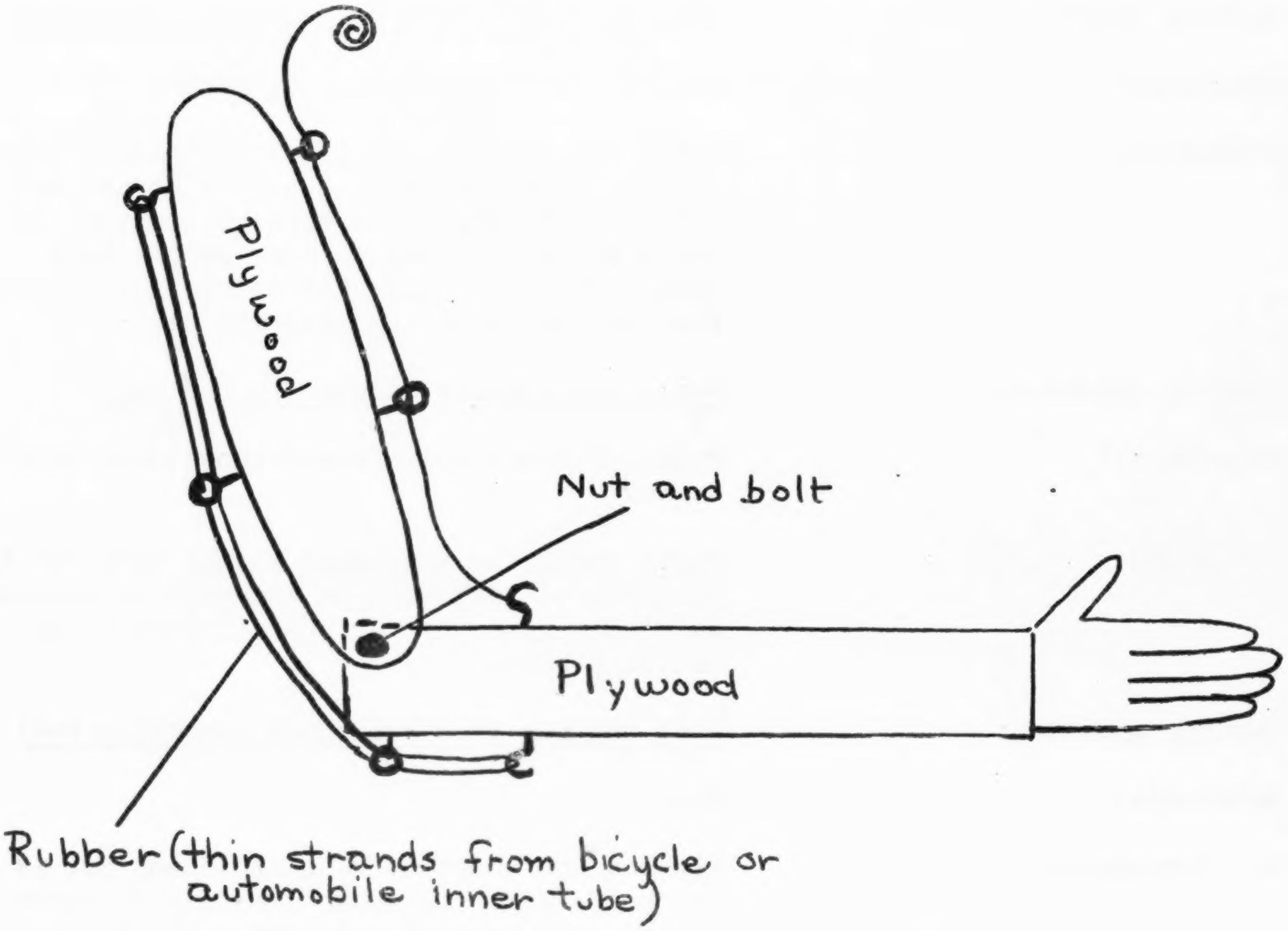
22. Leading Question: What happens when you touch something hot?

Materials: None

A. Procedure: Discuss what happens when something hot is touched? Why? Did you have time to think about what happened and then act? Do any other organs in the body work this way?

B. Procedure: This might be an opportunity to touch something cold. A good comparison can then be made. Why does the body react one way for hot and the other way for cold? Let the children actually touch two objects.

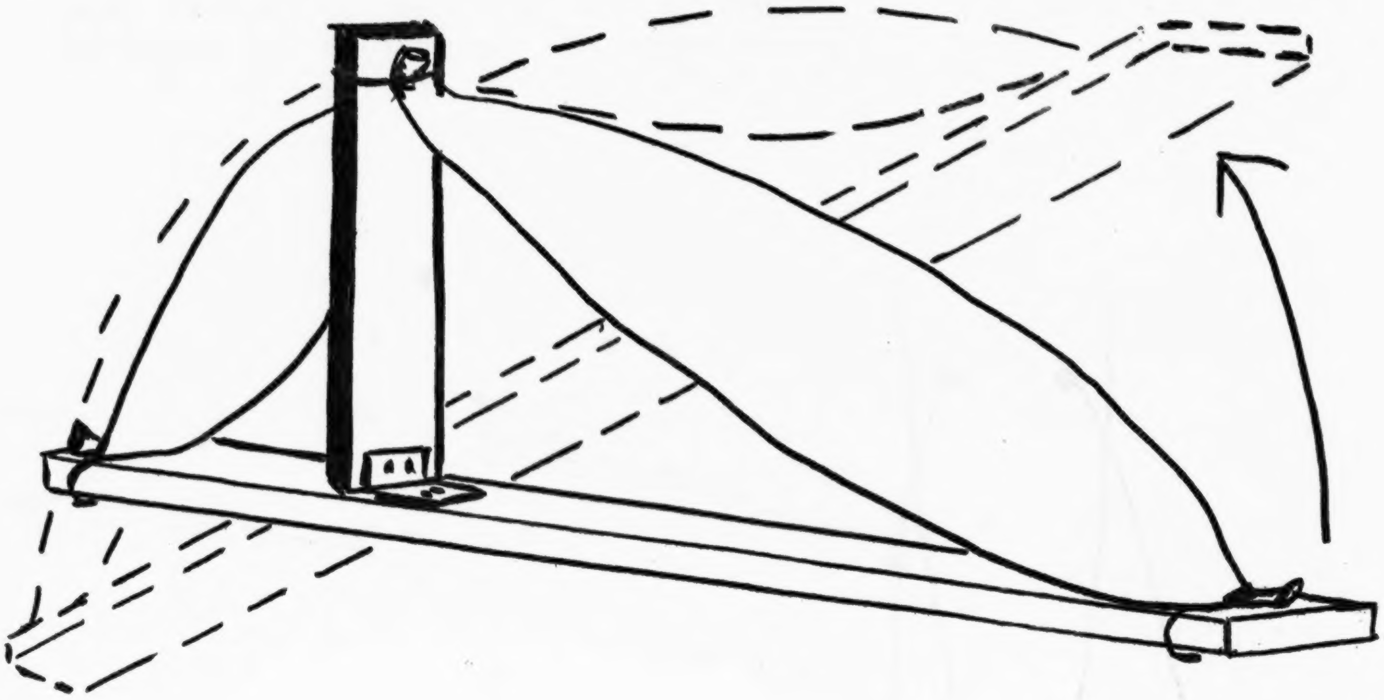
23. Leading Question:	How do arm muscles work?
Materials:	Two pieces of plywood or heavy cardboard, three cuphooks, cord string
Procedure:	After the model illustrated has been constructed encourage the children to operate the model and compare it to the workings of the human arm. Why can't the arm be bent at other than the elbow? Could the fingers be made to bend? How?


Plywood
Nut and bolt
Plywood
Rubber (thin strands from bicycle or automobile inner tube)

24. Leading Question: Do muscles have to work together?

Materials: Two balloons (preferably of different colors), small hinge, two pieces of wood

Procedure: After the model illustrated below has been constructed (perhaps by a few boys in the class,) the children should be encouraged to experiment with the device. Observe the shape of the balloons as you move the boards apart. Compare the results with the operation of body muscles.



25. Leading Question: Can muscles work alone?

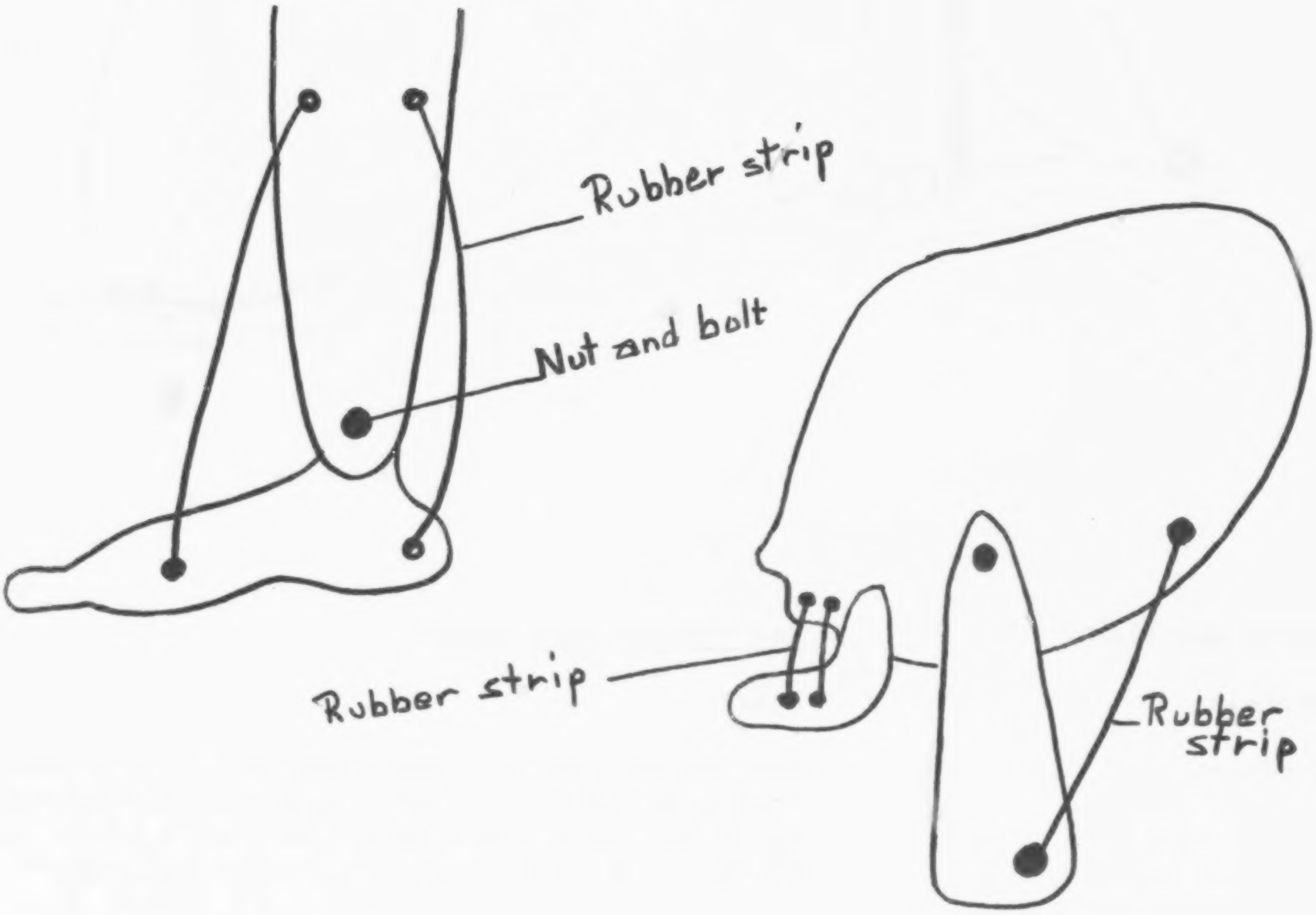
Materials: None

Procedure: Ask the children to locate the pair of muscles that move their forearms. Have them straighten their arm while pressing the hand to a solid surface. As they press down, have them feel the space between their elbow and shoulder and then feel the same space on the other side of their arms. How do they feel? Last, have them bend their arms at the elbow, while pulling the fist toward their faces. Why do the muscles feel different?

26. Leading Question: How do muscles act like levers?

Materials: Plywood sections cut to represent the foot and leg and the head and neck (see illustration below), rubber strips

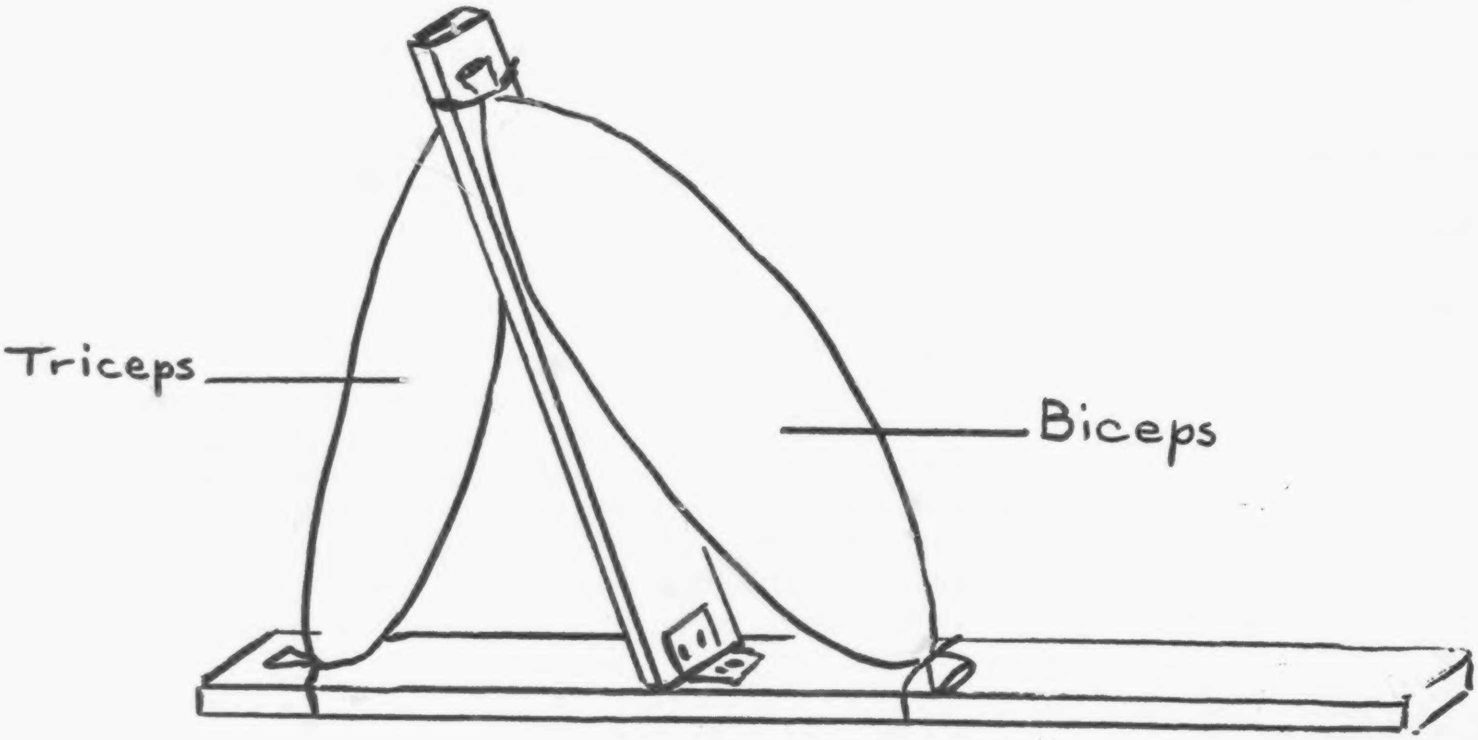
Procedure: After the models have been constructed according to the illustration, encourage the children to operate the models to see if they can compare them to the operation of levers. What happens as the parts move? Why does one stretch while the other contracts? Does this happen in the body? Why and where? What might happen if the muscles are stretched too far?



27. Leading Question: Are all muscles alike?

Materials: Two pieces of wood which are one inch square and one foot long, hinge, balloons

Procedure: The boys can construct the two devices pictured below. Have the children work the device with the purpose of discovering what happens when a muscle moves and also the difference between a bicep and a tricep muscle.



28. Leading Question: What are the silent movers of the body?

Materials: Dinner knife, hairpin (for each child or each group)

Procedure: Have the children hold the knife tightly in their hands and then place a hairpin astride the knife. The knife should then be elevated just enough so that the prongs of the hairpin just touch the table. Make certain that the pin is in a slanted position. What happens to the pin? Why?

Note to teacher: The pin walks along the knife because of the slight movement of the arm muscles which hold the weight of the knife.

29. Leading Question: How and why do body muscles change shape?

Materials: None

Procedure: Have the children demonstrate various activities such as pretending to throw a ball, rowing a boat, kicking a ball, etc. Encourage them to observe and then feel what is happening to the muscles of their arms and legs. Why are only certain muscles moving? Do they feel different when they are moving? Why?

Note to teacher: Obtain the model of the human body from the Science Materials Center to observe the various muscular systems in greater detail.

30. Leading Question: How are muscles different in size?

Materials: Tape measures

Procedure: Have the boys "make a muscle" in their upper arms. The girls can then measure around the arm where the muscle is the largest. Record the measurements. Now have the boys "make a muscle" with the other arm and have the girls record this measurement. Compare the results. Why is there a difference? (For most children the muscles in the right arm should be more highly developed because of more frequent usage.)

31. Leading Question: Do muscles ever tire?

Materials: None

Procedure: Have the children open and close their fingers as rapidly as they can for as many times as they can, keeping count if desired. Compare results. Why were some able to perform more effectively than others. Also note how long it takes until the muscles feel rested. Does this time vary when the period of exercise is shortened or lengthened? Why?

Note to teacher: This activity can be varied by using different types of physical activities.

32. Leading Question: What are muscles made of?

Materials: Piece of lean beef, stove

Procedure: Bring in a piece of lean fresh beef. Have the children observe the muscles of the beef in a natural state. Then boil the beef. Discuss with the children what happens. Why? (Tiny individual muscle fibers will appear). What function do the fibers perform?

33. Leading Question: How do muscles change the shape of the body?

Materials: Books, tape measures

Procedure: Children should divide into pairs. One child should then hold a book down at his side. The other member should then measure the arm at its thickest part. Then have them lift the books and again measure the distance around. What happened? Why?

34. Leading Question: Does the body move in different ways?

Materials: None

Procedure: Select children to demonstrate as many ways as possible of moving the whole body (e.g. walking, running) as compared to individual body movements (e.g. bending a toe). Encourage the children to see how many whole body and individual body movements they can find?

Note to teacher: To vary the activity, have the children discover ways the body is unable to move.

35. Leading Question: What is the body's structural system like?

Materials: Skeletal model can be obtained from Science Materials Center

Procedure: Have the skeletal model available for the children to examine and work with. Develop the idea of ribs protecting the lungs, the spinal cord the network for the nerves, etc.

36. Leading Question: How can small bones support body weight?

Materials: Book, sheets of paper

Procedure: Provide each group of children with sheets of paper and a book. Encourage them to devise ways for the paper to support the book's weight.

Note to teacher: By rolling the sheets of paper into a tight cylinder, they will be able to support the weight of the book. This can be compared to bone structure, in which the outer layers of cells are packed close together, forming a much stronger structure.

37. Leading Question: What keeps us straight?

Materials: Raggedy Ann doll, or other soft-stuffed doll, rulers

Procedure: Try standing the doll upright. What happens? Why? Encourage the children to devise ways of making the doll stand straight. What important bone keeps the body erect? Why can't the doll move it's leg properly? What built-in system does the body have that enables bending at knees and elbows?

38. Leading Question: Why do bones need minerals?

Materials: Two chicken bones of near equal size, vinegar, two glass jars

Procedure: Have the children place the two chicken bones in separate containers--one containing water and the other vinegar. Allow them to soak for at least two days. Why is one bone easier to break?

39. Leading Question: How do bones protect body organs?

Materials: Balloons, catcher's mitt, rubber balls

Procedure: Tape balloons to the blackboard. Select a child to throw balls at the balloons and try to break them. Are they easy to break? Why? Now have one child hold the catcher's mitt over one of the balloons and have the children try to break the balloon underneath. Why can't it be done? (Compare to the bones serving as protective devices for body organs).

40. **Leading Question:** What is the body's framework?

Materials: Pictures of buildings under construction

Procedure: Display a variety of construction pictures about the room. Through discussion, encourage the children to compare the framework of buildings to the framework of their bodies.

41. **Leading Question:** What moves the toes and fingers?

Materials: A chicken foot

Procedure: Allow the boys to cut the skin from the extreme top of an uncooked chicken foot. Behind the bone is the tendon. Observe what happens. Why?

A similar experiment can be done with a rabbit's foot.

42. **Leading Question:** Why is man's thumb so important?

Materials: Tape

Procedure: Divide the class into two teams--"A and B". On team "A", tape the member's thumbs to their index fingers. Have team "B" time team "A" while they perform everyday tasks, such as writing, threading a needle, shooting a marble, etc. Now, as a control, tape team "B's" middle and index fingers together and have them perform the identical tasks. Discuss how the times compare. Why?

43. **Leading Question:** Do all animals move in the same way?

Materials: None

Procedure: Discuss various animals and their methods of locomotion. How do they vary according to size and number of appendages? Be sure to compare birds, apes, horses, fish and snakes. How are the vertebrates movements different from those of the invertebrates? Why? The children may wish to make a picture collection that shows various animals in motion.

44. **Leading Question:** What does a human skeleton look like?

Materials: Old X-ray photographs

Procedure: Display a series of old X-ray photographs of various skeletal sections. See if the children are able to discover the names of any of the bones pictured.

45. Leading Question: Where are tendons located and why are they important?

Materials: None

Procedure: Encourage the children to feel the tendons in the hollow of their elbow, neck, heel and wrist. Ask them to note what happens as they are at rest and then in motion. How does movement result?

46. Leading Question: Do we give bones names?

Materials: Halloween skeleton, felt tip pen

Procedure: As a little extra project, a skeleton can be hung in the rear of the classroom where the children can label various bones. Some may even wish to find how many bones are in their body?

47. Leading Question: How do bone joints operate?

Materials: Chicken bones, stove

Procedure: Cook a thigh bone and lower leg bone of a chicken and also a thigh bone and a pelvic bone in soapy water to remove all the grease from the bones. (After such a process, they can be kept indefinitely). Place them on display and encourage the children to operate them. The thigh and lower leg illustrate a hinge joint and the thigh and pelvic bone illustrate a ball and socket joint. Then have them try locating these bone joints on a skeletal model or on their classmates. Encourage them to try and discover why the body is jointed.

48. Leading Question: What's inside a bone?

Materials: Large soup bones, saw

Procedure: Have some of the boys saw through some large soup bones. What can be observed? What purpose does this inner layer perform?

49. Leading Question: Are all bones alike?

Materials: Bones (Class Kit) Available from the Central Science Library.

A. Procedure: A comparative study of bones can be shared by the entire class by assembling 6 disarticulated skeletons (3 cats, 2 rabbits, 1 mink).

B. Procedure: Encourage the children to collect various types and sizes of bones. Compare them. Why are some shaped differently? Are they different colors? Why? Why might fish and birds have more delicate skeletal structures?

ACTIVITIES TO ASSIGN FOR HOMEWORK OR INDIVIDUAL RESEARCH

50. Leading Question: How fast do bacteria spread?

Procedure: Some students may wish to extend the table found in Activity #4 much further.

51. Leading Question: How deep does skin go?

Procedure: Some children may wish to investigate skin textures on various animals, e.g. elephant, snake, etc. Refer to Activity #16.

52. Leading Question: Where are muscles located in the body?

Procedure: Some children might be encouraged to sketch and label the muscular system. Refer to Activity #21.

53. Leading Question: How are muscles different in size?

Procedure: Several children might wish to research for exercises to strengthen muscles and then try them out on their classmates for an extended time period. Refer to Activity #30.

54. Leading Question: How do muscles change the shape of the body?

Procedure: Let the children discover how spools of thread and a string could make a model of the human backbone. Could felt be added between the spools and rubber bands connect them? What could they compare to in the body? Refer to Activity #33.

55. Leading Question: Do all animals move in the same way?

Procedure: Have the children compare the running speeds of different animals. Which is the fastest? Which is the slowest? Does size make a difference. Refer to Activity #43.

56. Leading Question: Where are tendons located and why are they important?

Procedure: Some children may wish to relate the legend of Achilles to the class. Refer to Activity #45.

57. Leading Question: Do we give bones names?

Procedure: Compare the differences in the structure and number of bones in various animals. Refer to Activity #46.

HUMAN BODY

GRADE 5

HUMAN BODY

Body Systems

Grade 5

Nervous System

UNDERSTANDINGS TO BE DISCOVERED	RELATED ACTIVITIES
The nervous system, consisting of nerves, spinal cord, and brain, enables us to be aware of our environment.	1
A neuron is the functioning structure of the nervous system.	2
Nerves connect all body parts with the spinal cord and the brain.	1
Sensory nerves carry messages from the sense organs to the brain.	3
Motor nerves carry messages from the brain, ordering movement.	3
Reflex action is an automatic response.	5, 7
The spinal cord acts as the pathway to and from the body and the brain.	1
The brain controls all of our actions.	1, 4
The cerebellum coordinates the movements of muscles.	4
The cerebrum is that portion of the brain controlling voluntary activities.	4, 6
The medulla controls involuntary body activities.	4, 6
Rest and relaxation help keep the nervous system healthy.	8, 47
Good mental health is necessary for good body health.	8, 47

HUMAN BODY

Body Systems

Grade 5

Respiratory System

UNDERSTANDINGS TO BE DISCOVERED	RELATED ACTIVITIES
Respiration is the process whereby air is inhaled and waste products are exhaled. (See also excretion, skin and digestion)	11, 12, 13, 14
Cells of the body need oxygen to live.	
There is external and internal breathing.	
The diaphragm is a muscle that enables the lungs and the rib cage to move.	9, 10, 11
Air enters the body through the nostrils where it is filtered and continues throughout the nasal passage, throat and trachea.	9, 11
Additional filtering is performed by the tonsils.	9
The trachea branches off into two small tubes called bronchi which enter both lungs.	9, 11
The bronchi become smaller as they branch off, ending with clusters of air sacs.	9
Air sacs are microscopic areas in the tissue of the lung where oxygen is exchanged for carbon dioxide.	9, 13, 14
Capillaries, connected to the air sacs, carry oxygen to the bloodstream.	9
The larynx is our voice box.	9
Cigarette smoking can cause damage to the respiratory system.	15, 47
Periodic chest X-rays help maintain good health.	15, 47
Breathing through the nose is better than breathing through the mouth.	15, 47
Use a handkerchief when you cough, spit or sneeze.	15, 47

Digestive System

UNDERSTANDINGS TO BE DISCOVERED	RELATED ACTIVITIES
Digestion is a physical and chemical process whereby bulky foods are broken into simple useful materials and waste products.	18, 23, 29
The alimentary canal (digestive tract) is a long tube to which digestive organs are connected.	16
Our body needs food to keep body cells alive.	16
The teeth rip, crush, and tear food.	16, 17, 18
Enzymes help change food into a form that the body can use.	19, 20, 23, 31
Saliva is an enzyme that breaks down starch to sugar.	19, 20, 31
Peristalsis is a muscular action within the digestive tract.	24, 25
The esophagus is a muscular tube that contracts in order to force the food from the mouth to the stomach.	16, 24, 25
The stomach is a muscular and elastic organ which moves to mash and mix food. (Physical action)	16, 26, 27
The stomach releases gastric juices and enzymes to help break down food. (Chemical action)	16, 26, 27, 31
The small intestine is a narrow coiled tube about twenty feet long.	16
Bile is produced in the liver and helps to break down fat.	16, 31
The pancreas releases pancreatic juices to split proteins, carbohydrates and fat.	16, 31
Bile and pancreatic juices enter the small intestine through tubes to aid digestion.	16

UNDERSTANDINGS TO BE DISCOVERED (Cont'd)	RELATED ACTIVITIES
Absorption is the process whereby digested foods pass through membranes into the bloodstream.	23, 28
Villi, in the small intestine, remove useful food particles to be absorbed in the bloodstream.	28
Peristalic action pushes food from the small intestine on to the large intestine.	25
The large intestine is a wide tube that passes on undigested food.	16
The appendix is a vestigial organ.	16
Undigested food, in the form of solid waste, passes out of the rectum and anus. (See also skin, respiration and excretion)	16
Carbohydrates give our bodies energy.	22
Excess carbohydrates are stored in our body as fat.	
Fat is another source of energy.	21, 22
Protein builds muscle and bone in the body.	
A sufficient supply of vitamins is necessary for the good health of the body.	30, 47
Minerals are necessary for strong healthy teeth and bones.	17, 30, 47
A well-balanced diet and drinking plenty of water aid in digestion.	47

Circulatory System

UNDERSTANDINGS TO BE DISCOVERED	RELATED ACTIVITIES
The circulatory system consists of the heart, blood, and blood vessels.	32
Blood supplies cells with necessary nourishment, fights disease and helps in body repair.	32
The heart is a muscle, about the size of the fist, whose pumping action forces blood throughout the body.	33, 36
There are four chambers in the heart; the upper two are called auricles and the lower two are called ventricles.	33
Blood makes a complete circuit around the body approximately every twenty-eight seconds.	32, 33
Valves in the heart keep the blood flowing in one direction.	33, 36
The blood picks up oxygen and rids itself of carbon dioxide in the lungs.	32, 33
Arteries are elastic tubes carrying blood away from the heart.	32, 33, 35, 36
Veins are tubes with valves that carry blood containing impurities toward the heart.	32, 33, 35, 36
Capillaries reach all cells of the body and at this point, the exchange of food and oxygen for waste matter takes place.	
Pulse is a rhythmic expansion of the elastic arteries due to the pressure created by the heartbeat.	34
Blood is composed of red corpuscles, white corpuscles, platelets and the liquid called plasma.	37, 41
Red corpuscles carry oxygen to the body cells and remove carbon dioxide.	37, 39

UNDERSTANDINGS TO BE DISCOVERED (Cont'd)	RELATED ACTIVITIES
Hemoglobin is a compound of iron in red corpuscles.	37
White corpuscles protect against bacteria.	
Clotting is a protective mechanism of blood caused by the platelets.	37, 38
There are different types of blood.	40
Heart disease is the number one cause of death.	42
Diet, exercise, sufficient sleep, and freedom from worry help to keep a healthy heart.	42, 47
A periodic medical check-up is a part of good health.	42, 47

Body Systems **Grade 5**

Excretory System

UNDERSTANDINGS TO BE DISCOVERED	RELATED ACTIVITIES
The kidneys are the body's cleansing organs.	43
The kidneys remove waste from the blood as it travels through a maze of tiny filters or coiled tubes.	43, 44
The ureter is a tube that carries liquid waste from the kidneys to the bladder.	43
The bladder is a reservoir for temporary storage of liquid waste matter called urine.	43
When the bladder begins to fill, a nerve sends messages to the brain.	43
Urine passes out to the body through a tube called the urethra.	43
When the muscle around the urethra relaxes, the waste liquid is forced out.	43
There are other forms of excretion of the body. (See also respiration, skin and digestion)	
Proper diet helps in healthy elimination.	45, 47

HUMAN BODY

Body Systems

Grade 5

Endocrine System

UNDERSTANDINGS TO BE DISCOVERED	RELATED ACTIVITIES
The endocrine system is made up of glands that manufacture special fluids.	46
These ductless glands pour their fluids directly into the bloodstream.	46
The pituitary gland is the master gland of the system and effects growth.	46
The adrenal glands help prepare the body for an emergency by regulating blood pressure.	46
The thyroid helps regulate the speed at which body cells can work.	46
The parathyroids control the speed at which calcium is used by the body.	46
The islands of Langerhands control the ability of the body to use sugar with the hormone called insulin.	46
The thymus and pineal are glands of which very little is known.	46
The gonads (testes and ovaries) are glands which determine sexual characteristics.	46

Heredity

UNDERSTANDINGS TO BE DISCOVERED	RELATED ACTIVITIES
Heredity is the passing of traits from parents to children.	48, 49
Hereditary material is concentrated in the chromosomes.	
Chromosomes are located in the nucleus.	
Genes, subdivisions of chromosomes, determine body traits.	
There are dominant and recessive traits.	50, 51

ACTIVITIES

1. Leading Question: What makes up the body's telephone system?

Materials: Chart of nervous system or picture to be used with opague projector. (A class committee could draw an enlarged picture of an oversized human body.)

Procedure: Show the picture of the nervous system to the class. (This picture might also be prepared by a committee of children who have done research and studies on the nervous system.)

Discuss such questions as the following:

1. What is the main center of this system?
2. Locate the spinal cord. What are its functions?
3. Where are the nerves? What is their purpose?
4. What importance does this system play in our body?

Note to teacher: Overlays for the overhead projector are available from the audio-visual department.

2. Leading Question: How does the neuron function in the nervous system?

Materials: Research books, large drawing paper, paint or crayons

Procedure: Have a child or group of children do research on the neuron. They should be prepared to make an enlarged picture of it with its parts labeled.

This picture should be used in a presentation to the class. Show the importance of the neuron as a functional part of the nervous system. Also demonstrate the remaining major parts of the nervous system and their functions in connection with neurons.

3. Leading Question: Which nerve does it?

Materials: Research books

Procedure: Have the class do research on the main types of nerves--sensory and motor. Discuss their make up and function.

Play a game called "Which nerve does it." Set up teams and have them take turns answering questions worth one point (rules can be adjusted accordingly.) Some examples of questions are:

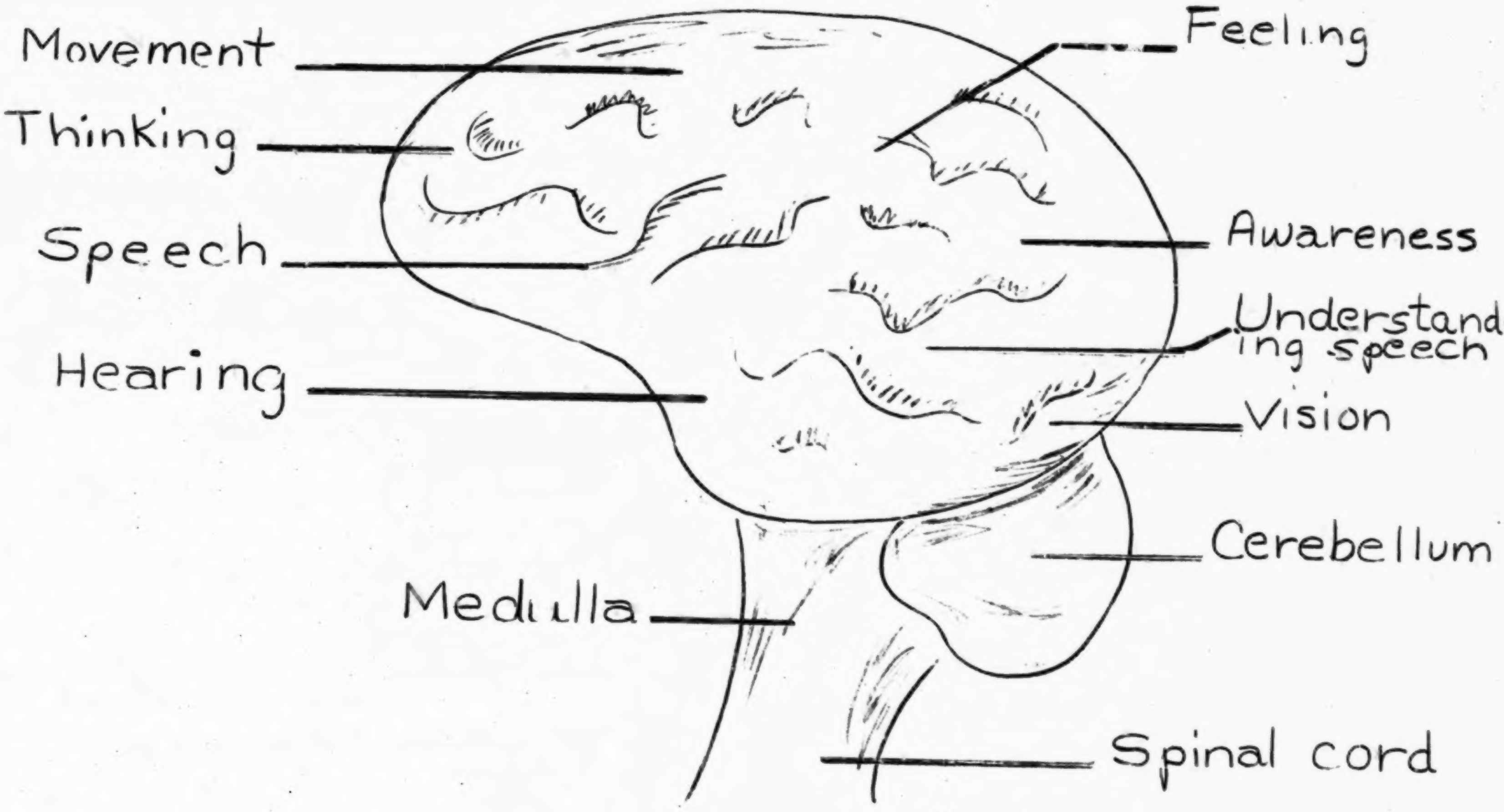
Which nerve carries the message
1. move your little finger (motor)
2. sour milk (sensory)
3. good chocolate cake (sensory)
4. skip rope (motor)
5. green dress (sensory)
6. barking dog (sensory)
7. cross your leg (motor)
8. rough wood (sensory)

The children can pantomine the actions in order to vary the game.

4. Leading Question: What parts of the brain help us do various things?

Materials: Large paper, paint, black crayons, research books

Procedure: Have a group of children collect research on the brain and formulate a picture of its form. Then have them discuss the way it affects our body. Discuss the importance of the brain as a master control of our actions.


Movement
Thinking
Speech
Hearing
Medulla
Feeling
Awareness
Understanding speech
Vision
Cerebellum
Spinal cord

5. **Leading Question:** Do all people have the same reaction time?

Materials: None

Procedure:

Clap your hands together in front of the class. Tell the students to watch carefully as you clap your hands. Tell them to clap their hands at the same moment you clap yours. Be careful not to use a rhythmic pattern that they can anticipate.

Make the following observations:
1. Is there a lapse in time between your clapping and their clapping?
2. Do all the members of the class react at the same rate?

Draw conclusions to the leading question that was asked.

6. Leading Question: What is the difference between voluntary and involuntary actions of our bodies?

Materials: Pencils and paper

Procedure: Have each child make a chart similar to the following:

	Voluntary	Involuntary
Eating		
Breathing		
Digesting		
Drinking		
Picking up food		
Laughing		

After each action, have the child place a check in the proper column, depending on the type of activity it is. Relate this to the parts of the brain and their functions.

Note to teacher: Discuss the meaning of voluntary and involuntary.

7. Leading Question: What is a reflex action?

Materials: Cellophane, six sheets of paper, a partner

Procedure: Have a child crumple 6 sheets of paper into 6 balls. Have him put one of the crumpled balls in his hand and set the other 5 aside.

The partner should then hold the piece of cellophane in front of his eyes and look directly at the other person. The person with the ball in his hand should then throw the paper ball gently against the piece of cellophane. Make observations as to whether or not the person (with the cellophane) blinks.

Tell the person with the cellophane to try very hard not to blink as his partner throws several more paper balls at him. Can it be done?

Have the children exchange places and repeat the activity. Make comparisons. Relate this to a reflex action. Discuss other similar actions performed by the body.

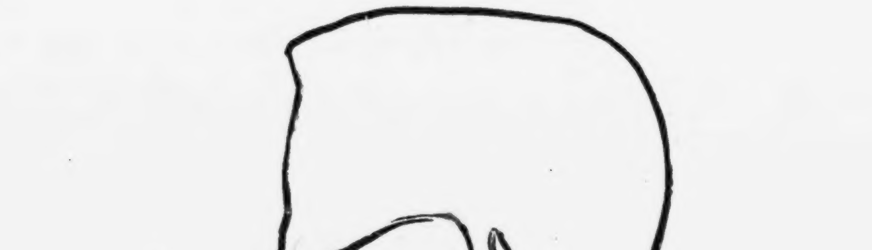
8. Leading Question: What helps to keep our nervous system healthy?

Procedure: Discuss with the class ways in which rest and relaxation help to keep the nervous system healthy. Add other thoughts from the class to the healthy hints.

9. Leading Question: How do we breathe?

Materials: Research books, transparencies of respiratory system, overhead projector, large picture or chart of system

Procedure: Have a group of children do research on the parts and functions of the respiratory system. They might want to draw an illustration like the following in order to present their report to the class.



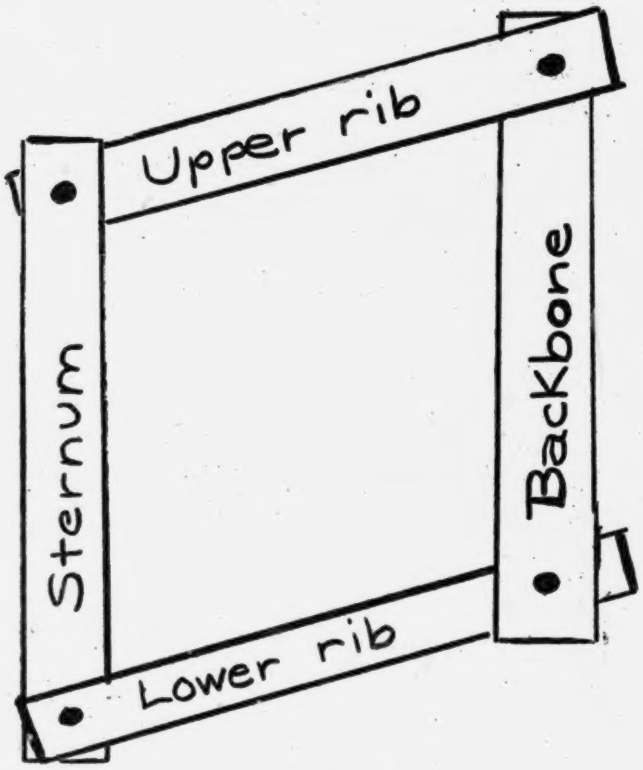
If this picture is not drawn, use transparencies on the opaque projector.

Be sure they include throat, nasal passages, trachea, tonsils, bronchi, lungs, larynx, and diaphragm. Beside the main parts of this system, they should discuss: (1) how air is filtered when it enters the body, (2) where oxygen is exchanged for carbon dioxide, (3) how oxygen gets into the bloodstream.

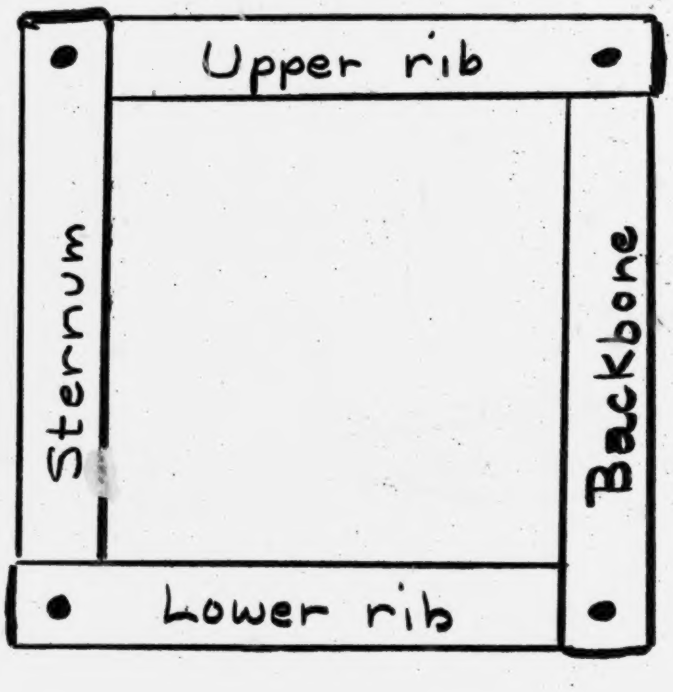
10. Leading Question: Does the chest volume increase or decrease while breathing?

Materials: Cardboard, four paper fasteners, crayon or felt tip pen, tape measure

Procedure: Cut four equal strips of cardboard and label them sternum, backbone, upper rib, and lower rib. Fasten them together with paper fasteners in the order shown in the diagram. Hold the backbone in one position and move the sternum up and down. Make comparisons and conclusions concerning the volume of the chest in the different positions. Compare this with actual diagrams of the thorasic girdle. Relate the diaphragm to this. In addition measure a child's chest cavity with a tape measure as he inhales and exhales.



A. Passive Position



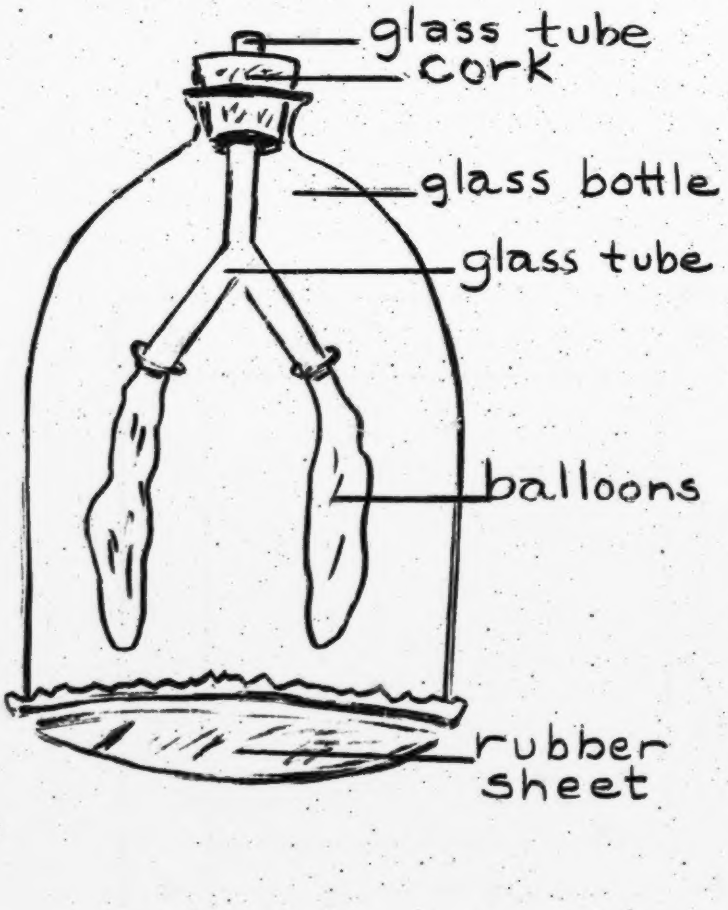
B. Volume of chest cavity increased

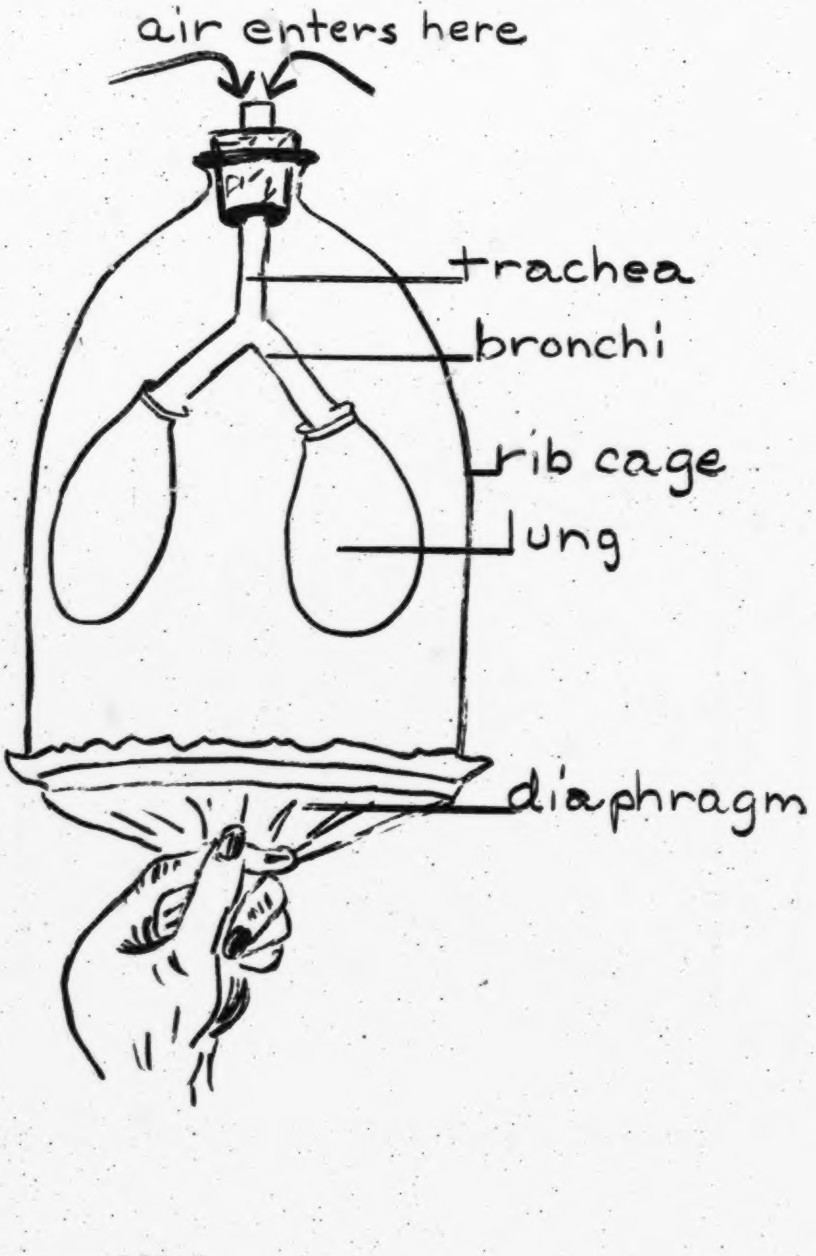
11. Leading Question: How does air enter our lungs?

Materials: Artificial breathing apparatus shown in illustration (available at Central Science Library) chart or picture of respiratory system with labeled parts

Procedure: Obtain the apparatus seen in the illustration. Have the children observe noticeable characteristics of the model and relate the balloons, glass tubing, glass bottle and rubber sheet to what they represent in the respiratory system. Have someone pull down on the rubber sheet and observe what happens. Discuss:

1. What happens to the balloons?
2. Why does this happen?
3. How is air pressure connected?
4. How is this related to our breathing?
5. What happens when the rubber sheet is returned to starting position?


glass tube
cork
glass bottle
glass tube
balloons
rubber sheet


air enters here
trachea
bronchi
rib cage
lung
diaphragm

12. **Leading Question:** Does everyone breathe at the same rate?

Materials: Clock, watch with a second hand, chalkboard, chalk

Procedure: Prior to the science lesson, place the following table on the chalkboard.

Times inhaled in one minute	Number of pupils
11 times or fewer	
12 - 15 times	
16 - 18 times	
19 - 21 times	
22 times or more	

Have the class pair off with partners. Each person on the team is to perform two duties. One person will watch the clock to signal the beginning and end of one minute. While the minute is being timed the second person is to breathe at a normal rate and silently count the number of times he inhales. This number should then be recorded on a small piece of paper and set aside. The members on the team now switch jobs. When the entire class has discovered their breathing rate, have a child fill in the table on the board. A show of hands can be given for the areas on the table.

Compare and make conclusions concerning the results. Discuss the following questions:

1. Did everyone inhale at the same rate?
2. What was the slowest rate in the class and how many people were in this group?
3. What was the fastest rate and how many people were in this group?
4. Which area had the greatest amount of people in it? Compare this to averages studied in arithmetic.
5. When might your rate of breathing change?

13. Leading Question: What do your lungs exhale?

Materials: Limewater, jar, straw, mirror

Procedure: Fill a jar with limewater. Have a child exhale through the straw into the limewater. Observe the change in the limewater. (This shows the presence of carbon dioxide.)

Have another pupil hold a mirror close to his face and exhale. The moisture that appears will show that a form of water vapor is also expelled.

14. Leading Question: What element does our body give off when we exhale?

Materials: Paper bag, limewater, flat dish, paper clips

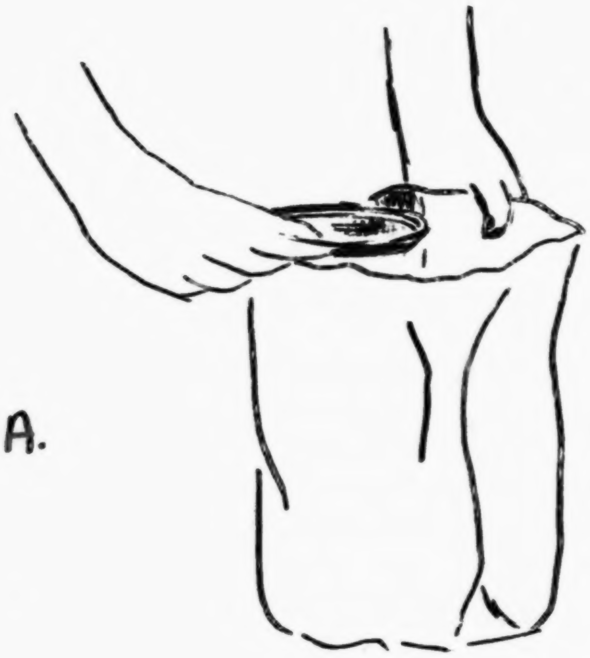
Procedure: Have a child fill the dish with limewater and place it inside a paper bag that is resting on the table. Record the appearance of the limewater. Have someone fold the opening of the bag around his mouth so that his breath goes into the sack. He should then breathe in an out of the sack ten times. Carefully remove the limewater from the bag and record its appearance once more.

Place another dish of limewater in a bag and fold over the top and clip it with paper clips. Open the sack in approximately ten minutes and make observations.

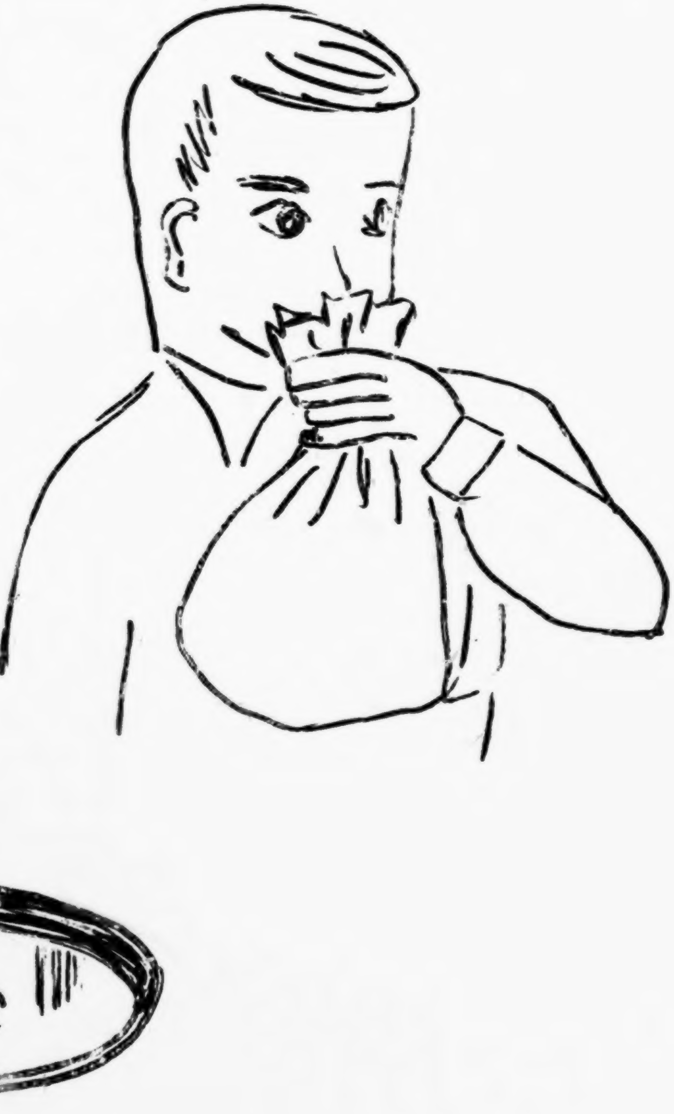
Let some clear limewater stand out over night and observe again. Speculate as to how the carbon dioxide reached the limewater each time.

Note to teacher: When limewater comes in contact with carbon dioxide it turns into a milky substance.

A.



B.



C.

15. Leading Question: How can we help to maintain good health in our respiratory system?

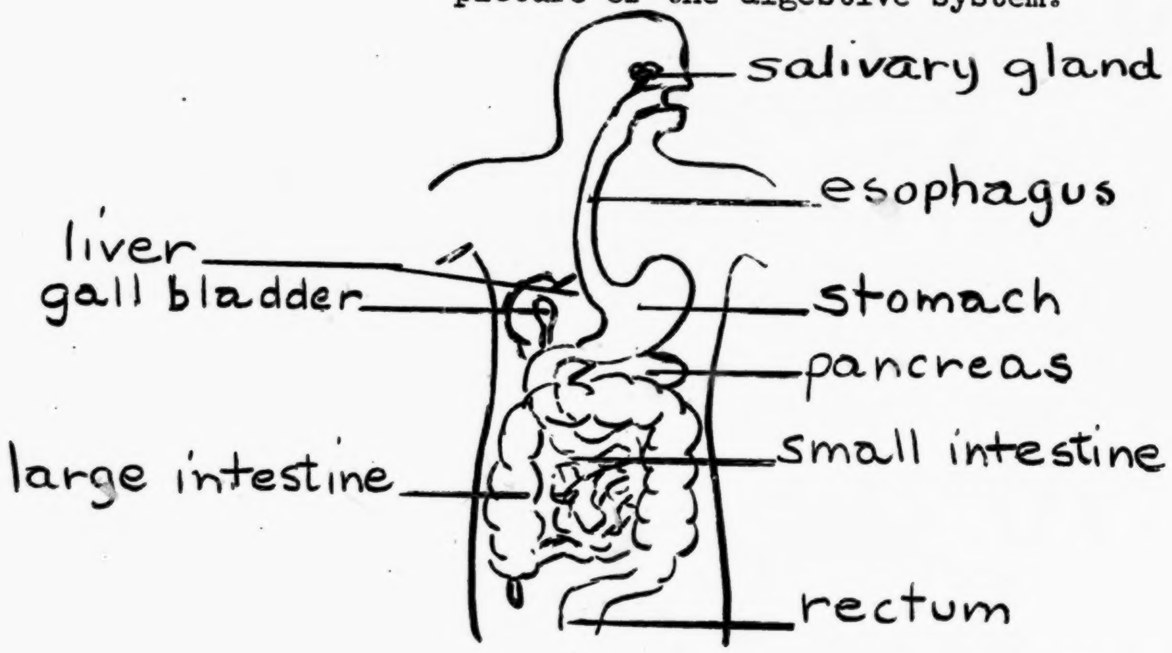
Materials: Research books

Procedure: Through research and class discussion determine how smoking, x-rays, proper breathing and cleanliness help to maintain a healthy respiratory system.

16. Leading Question: What happens to the food we eat?

Materials: Paper, paint, resource materials

Procedure: Have a group of children do research on the digestive system and be able to explain its parts and functions. As a culminating activity, encourage the class to draw a picture of the digestive system.


salivary gland
esophagus
liver
gall bladder
stomach
pancreas
small intestine
large intestine
rectum

Be sure they include the mouth, salivary glands, esophagus, stomach, small intestine, pancreas, liver, large intestine, appendix, rectum, anus.

They should be able to trace a piece of food through the system.

Discuss the following: (1) Why is food so important to our body? (2) What is meant by the Alimentary canal? (3) What is the length of the small intestine?

17. **Leading Question:** What is the first important step in digesting foods?

Materials: Large paper, paint, clay

Procedure: Have a group of children do research on the teeth and the role they play in digestion. Encourage them to make a large picture of the teeth in the mouth showing the certain types and their functions in the first step of digestion.

By using clay they can make a model of a tooth. This can be constructed so it can be taken apart and the inside of the tooth and its structure can be seen. Include:

- dentin
- enamel
- cement
- pulp cavity
- nerves
- blood vessels

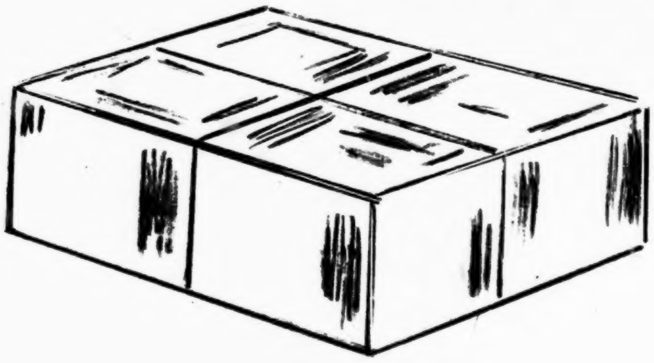
Be sure to relate this discussion to the proper care of the teeth.

18. **Leading Question:** Why is it important to chew food?

Materials: Blocks, sugar cubes, or illustrations of board potato

Procedure: Place the blocks or cubes in the position shown in picture A of the illustration. Ask the children to count the number of sides of the cubes that are not covered.

Separate the cubes as in picture B. Count again the sides that are uncovered. Relate this to broken food being digested by enzymes. Why is it better to have digestive enzymes touching as many sides of food as possible? Corelate this to chewing food carefully.



A.

B.

19. Leading Question: What does saliva do to starch?

Materials: Cornstarch, warm water, Benedict's solution, 2 test tubes, a glass, a beaker, teaspoon, gummed labels, hotplate

Procedure: Mix a level teaspoonful of cornstarch in a glass of warm water. (Starch will not dissolve in solution so it will appear cloudy.) Label the test tubes as A and B. Pour the solution into each tube so that the tubes are half full. Add a teaspoonful of saliva to test tube A, and a teaspoonful of warm water to tube B. Shake both test tubes and place in a beaker filled with warm water. Wait ten minutes and add one teaspoonful of Benedict's solution to each test tube.

Heat the test tubes in the beaker of water. Make observations as to what happens when the water boils. Benedict's solution will change color in the presence of sugar. What has happened to test tube A with the starch? Compare the reaction in both test tubes. Analyze and draw conclusions as to the use of saliva in the digestion process.

Note to teacher: Explain enzymes to class before doing this activity.

20. **Leading Question:** What effect does saliva have on starch?

Materials: Fehling solution, iodine, six test tubes, soda crackers

Procedure: Select two students to test for starch and two students to test for sugar. Select another child to supply saliva for the activity. Have him place the saliva in two test tubes. Label these tubes A and B. Using the Fehling solution, check tube A for sugar and record the results on the chart which is placed on the board. Using the iodine, check tube B for starch and again record the results.

Place a small piece of soda cracker in a tube labeled C and also a small piece of cracker in a tube labeled D. Test tube C for sugar and D for starch. Record findings. In tube E, place a very small piece of crushed soda cracker. Cover it with water and add a supply of saliva. Shake the tube and allow it to sit for ten minutes. Test the tube for sugar and record on the chart. Crush a very small piece of soda cracker and place it in tube F. Cover it with water and add an abundant supply of saliva. Shake the contents and allow it to sit for ten minutes. Test for starch and record on chart.

Make conclusions in the following areas:
Did the saliva effect the starch in the cracker? If so, in what way? What place does saliva play in the process of digestion?

Note to teacher: Discuss what enzymes are before doing this activity.

CHART

Test tubes	Action taken	Conclusions
A		
B		
C		
D		
E		
F		

21. Leading Question: What is the test for fats?

Materials: Paper, salad oil

Procedure: Place a piece of fat or a drop of salad oil on a piece of paper, Make observations as to what appears on the paper. Does the mark dry quickly? Does light pass through the mark easily? Place sugar on the paper and compare the mark it leaves to that of the fat. Test other foods for fat such as nuts, meat, flour, fruit, etc.

22. Leading Question: What tests tell us if food contains starch, simple sugar or fat?

Materials: Water, cornstarch, iodine, glasses (baking powder, orange juice, rice, flour, fruit)

Procedure: Add water and a pinch of cornstarch to a glass of clear water. Fill another glass with water and do not add cornstarch. This serves as a control for the experiment. Add a drop of iodine in the plain water making observations and recording. Then add a drop of iodine in the water mixed with cornstarch and observe. Compare the results found in both experiments.

Test various other materials the children may suggest, such as:
baking powder
bread
orange juice
rice
flour
fruit, etc.

Note to teacher: When iodine is combined with starch it turns a blue black color.

23. Leading Question: What happens to food before it enters the blood?

Materials: Measuring cup, water, $\frac{1}{2}$ teaspoonful sugar, and $\frac{1}{2}$ teaspoonful cornstarch, 2 test tubes, microprojector, slide cover slip

Procedure: Ask a child to mix $\frac{1}{2}$ teaspoonful of sugar into a quarter cup of water and then pour this mixture into a test tube. Label this tube A. Then mix $\frac{1}{2}$ teaspoonful of sugar into $\frac{1}{4}$ cup of water and lable this as tube B.

Shake the test tubes rapidly and make comparisons. Do both the starch and the sugar seem to disappear (dissolve) in the water? Observe differences in the appearance of the water. Does either the starch or the sugar seem to disappear?

Prepare a slide of a drop of each mixture and make observations under the microprojector. Can the starch grains be seen? Can the sugar grains be seen?

Discuss how food must be dissolved with water in order to enter the blood. Conclude whether or not starch can get into the blood. Can sugar get into the blood? If a food contains starch and sugar (carbohydrate) what must be changed in order to be passed into the blood?

24. Leading Question: What causes food to go from our mouth to our stomach?

Materials: Pillow, piece of bread, glass of water, straw

Procedure: Direct the children to close their eyes and think of their favorite food. Ask someone to describe what happened in the mouth when they concentrated on the imaginary food. Discuss why this sensation occurs.

Ask what makes food pass from the throat to the stomach. Gravity is a common answer. Put a pillow on the floor in the corner of the room. Have a child stand on his head, using the pillow for portection, and let him balance himself with the aid of the walls. Give him a part of the bread and tell him to swallow it. Observe what happens and have the children infer why it happens.

Experiment with a child trying to take a drink through a straw while standing on his head. What conclusions can be made regarding the gullet? Is food pushed in?

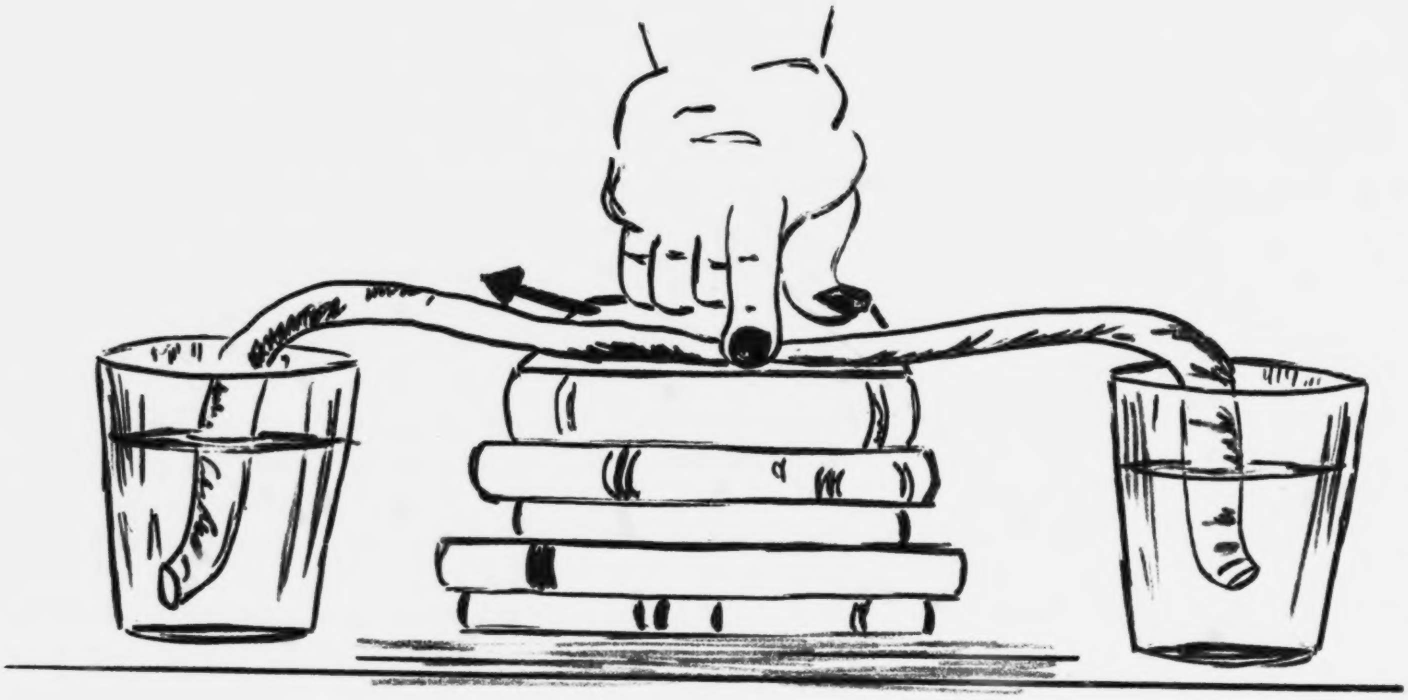
Note to teacher: This activity might work best immediately before lunch.

25. **Leading Question:** What makes food move in our body?

Materials: 2 glasses, rubber gum tubing, books, water

Procedure: Direct a child to fill a glass with water. Take a piece of rubber tubing, about two feet long, and fill it with water. Pinch both ends of the tube to retain the water in the tube. Place one end of the tube in a glass of water and place the other end in an empty glass. This will begin a siphoning action. When the water in both glasses reaches the same level place a few books between the glasses.

Stroke across the tubing with the finger and keep stroking in the same direction to show a comparible form of peristalsis. Observe what happens to the water level in the glasses. Relate this to the human body.



26. **Leading Question:** How does the stomach operate as a digestive organ?

Materials: Flour and water, plastic bag, food color, rubber band

Procedure: Mix the flour and water together to form a dough that is more dry than sticky. Place a single drop of food color on the dough and place it in the plastic bag. Close the bag and secure it tightly with a rubber band. Knead the bag with the hands to show how the stomach mixes the food. Observe what happens to the food color which represents digestive enzyme. Compare to activity the use of the stomach as a digestive organ.

27. **Leading Question:** What happens to food in the stomach?

Materials: Two cubes of sugar, two balloons

Procedure: Place a cube of sugar in each balloon and add a cup of water to each. While one balloon remains motionless squeeze the other balloon in and out in a continuous motion. After one minute of the above action compare the contents of each balloon.

Compare the activity to the balloons being the stomach, the sugar-the food, and the motion-the muscular activity. The action of the muscles breaks up the food and mixes it with digestive juices.

28. **Leading Question:** How do liquid food particles pass through the small intestine into the bloodstream?

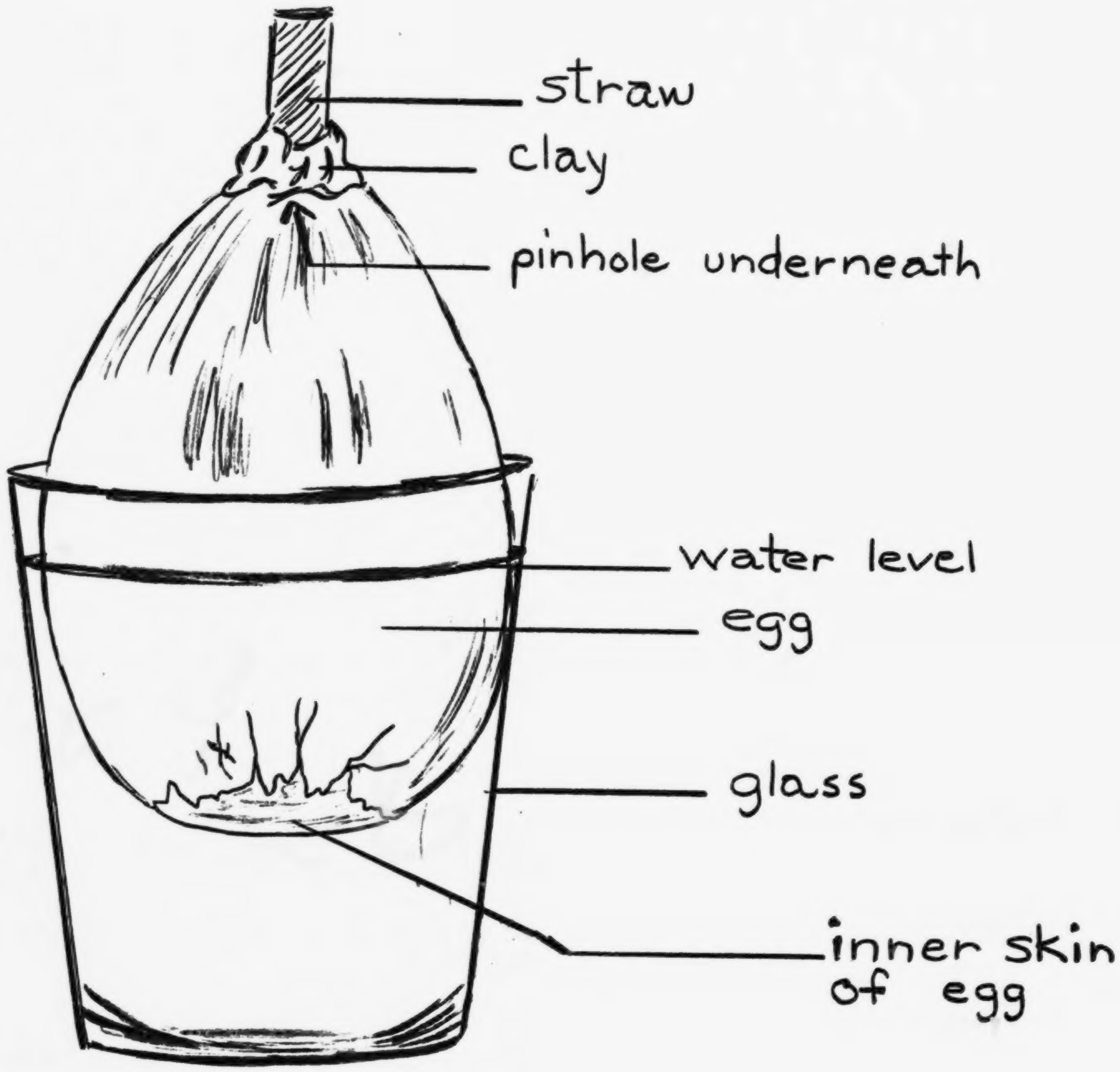
Materials: Plastic straw, modeling clay, water, glass, egg.

Procedure: Take a small glass into which an egg will fit without touching the bottom. Very carefully peel away some of the shell from the wide end of a fresh egg. Be careful not to break the thin interior skin.

Place the egg in the glass and fill the glass with water, enough to come half-way up the side of the egg. The peeled portion of the egg should face the bottom of the glass.

Make a pin-hole through the shell and the skin at the top portion of the egg. Cut the plastic straw into an inch segment and attach it with the modeling clay over the hole.

Observe the experiment every 15 minutes and record data. Discuss what happens, why it happens and how this is related to the small intestine. Discuss the villi in the small intestine and draw conclusions.


straw
clay
pinhole underneath
water level
egg
glass
inner skin of egg

29. **Leading Question:** Why must foods go through the process of digestion before they feed the cells of the body?

Materials: Bits of various foods, jars or beakers, water, recording chart

Procedure: Select a small group of children to perform this activity. Prepare a chart such as the following:

Food	Appearance after being mixed with water	Dissolved	
		Yes	No
Sugar			
Butter			
Fish			

Have the children in the experimental group choose various bits of foods, such as fish, meat, sugar, butter, and mix them with water. Observe what happens and record accordingly on the chart. Have the group familiarize the remainder of the class with the experiment and lead a discussion including the following areas:

(1) compare the foods that did and did not dissolve.
(2) can an undissolved substance pass through a cell membrane?
(3) could the food dissolved in water get into body cells?
(4) how does digestion help get food into cells?

30. Leading Question: What do vitamins and minerals do for our body and what foods are a source of these?

Materials: Large paper, research books, magazines for pictures

Procedure: Have a group of children do research on vitamins and minerals and then set up a chart similar to the following:

VITAMINS

Vitamin	Use of in body	Source	Pictures
A			
B_1 (Thiamine)			
B_2 (Riboflavin)			
Niacin			
C (Ascorbic Acid)			
D			
E			
K			

MINERALS

Mineral	Use in body	Source
Calcium		
Chlorine		
Cobalt		
Copper		
Iodine		
Iron		
Magnesium		
Phosphorus		
Potassium		
Sodium		
Sulfur		
Zinc		

31. **Leading Question:** What are the secretions in our body that aid in the digestion of food?

Materials: Paper and pencil or ink, research books

Procedure: Have the class or a group of children look up the following enzymes and fill in the chart:

Juice	Where produced	FUNCTION
Saliva		
Gastric juices		
Bile		
Pancreatic juices		
Intestinal juice		

Depending on the type of class you might want to get more specific in the area of enzymes. Each juice on the above chart has specific enzymes in it that are responsible for chemical changes. For example, you may also include:

pytalin
pepsin
lepase
tryptase
amylase
lactase
erepsin
maltase
sucrase

32. **Leading Question:** What is the river of life and how does it flow?

Materials: Picture of circulatory system, reference books

Procedure: Obtain a picture of the circulatory system from one of the following:

(1) overlay for the overhead projector (available from audio-visual dept.)
(2) picture for use in the opaque projector
(3) picture drawn by a group of children after they have done research on the circulatory system.

Have a group of children do research on this system and discuss the following:

(1) What functions does the circulatory system perform?
(2) What makes up this system?
(3) How much of the body does it effect?
(4) Why does blood pass through the lungs?

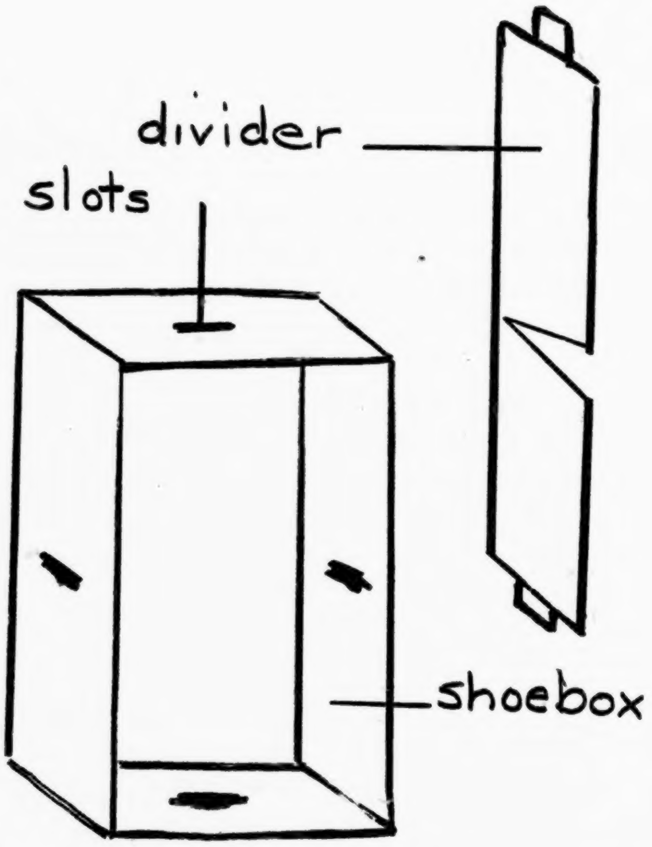
It will be fun to use a picture and trace a drop of blood from a spot in the body, through the circulatory system and back to the beginning spot. This should be done after the study of the circulatory system when the children are more familiar with it.

33. Leading Question: How does your heart work?

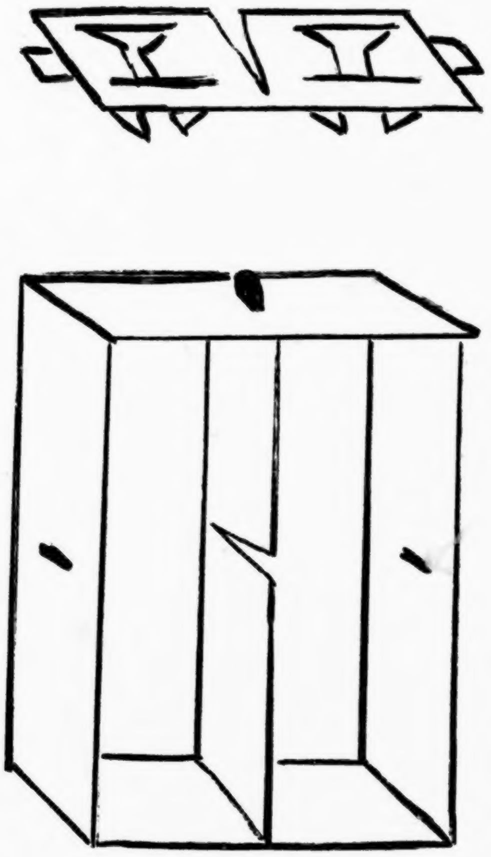
Materials: Shoe box, oaktag, scissors, scotch tape, paint, brushes

Procedure: Have each child or a group of children make the model of the heart pictured in the illustration.

Divide the shoe box in half and cut in slots to hold tabs of the sectional dividers. Measure the dividers so they fit the box, being sure to include tabs and valve slits as part of their construction. (see figures 1 and 2) Cut out holes at the proper places and in the proper sizes to hold the tubes that will represent the veins and arteries. Insert the dividers into the shoe box, attaching them with the tabs. (see figure 3) Roll oaktag into tubes and fit the tubes into the proper holes, securing them with tape. (see figure 4) Paint the arteries red and the veins blue. Use the model heart to trace blood through the chambers and blood vessels. In discussion, be sure to note the valves in the heart and their uses.


divider
slots
shoebox

①



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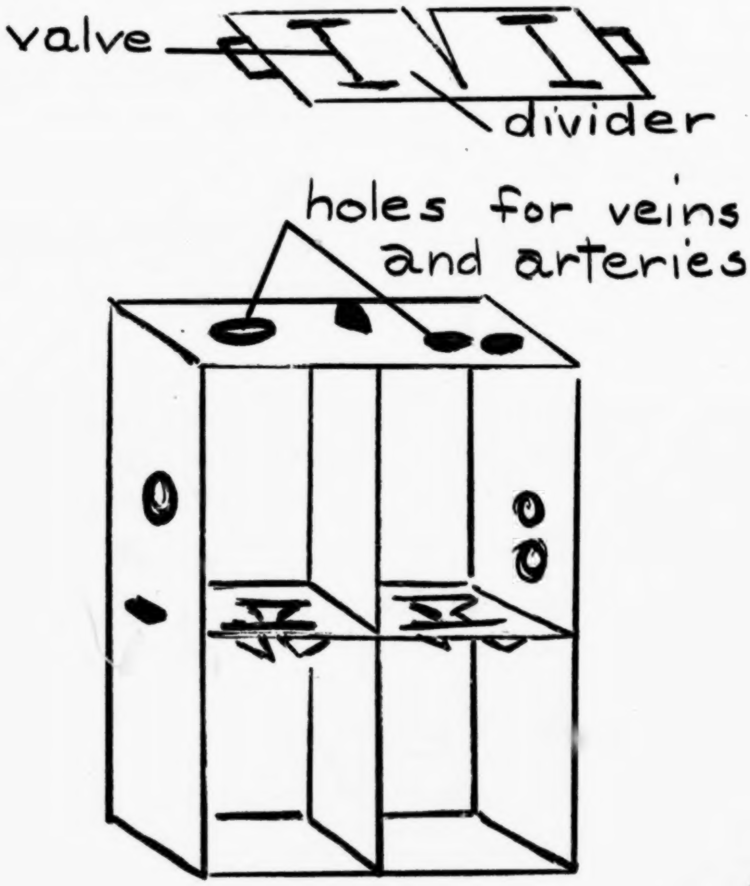
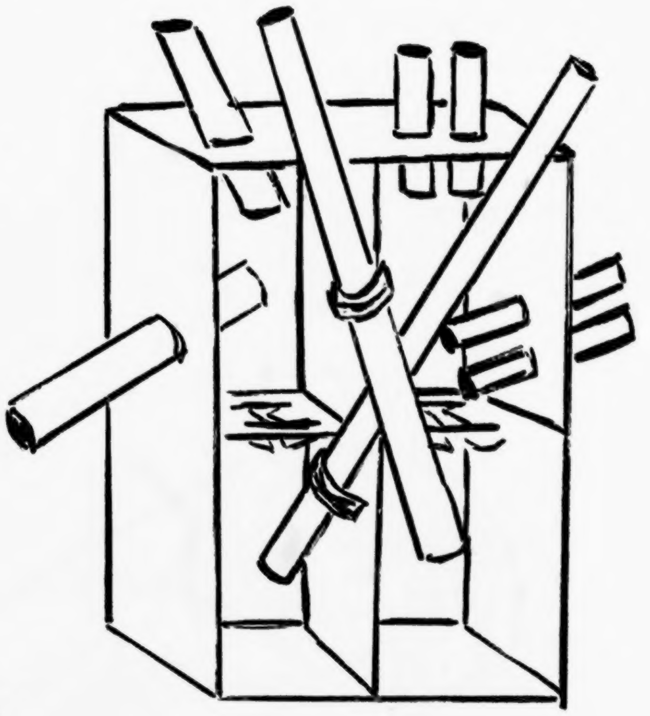

valve
divider
holes for veins and arteries

③



④

34. Leading Question: Is your pulse rate always the same?

Materials: Clock with second hand

Procedure: Confront the class with the following problem.

Jane and Susan counted their pulse rates. Jane recorded her rate as 72 beats each minute and Susan's rate was 74 beats per minute. Just then their teacher said, "Will one of you please return this book to the upstairs office? Please hurry!" One of the girls went on the errand. When she returned both girls recorded their pulse rate again. This time Jane wrote down 76 beats per minute and Susan wrote down 74 beats per minute. Which girl went on the errand? Why?

Investigate to find out if your reasons are substantial. Have the class take their pulse rates in various ways: while sitting - after running - while walking rapidly and so forth. Compare results.

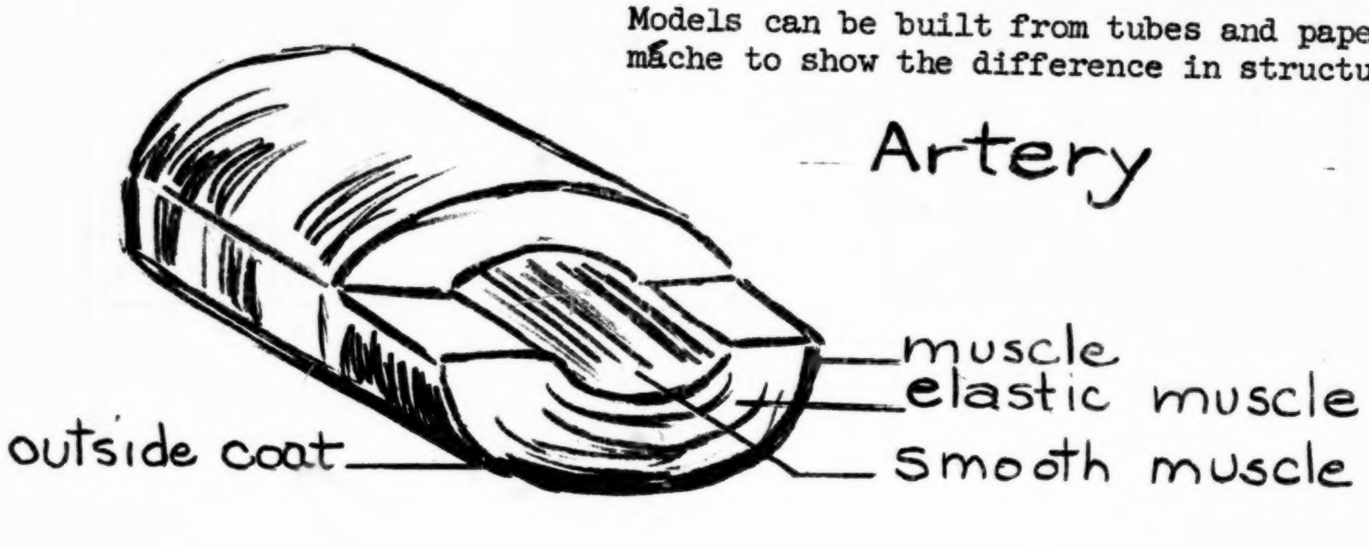
Note to teacher: Before doing this activity the children should understand what pulse is and how you feel and measure your pulse.

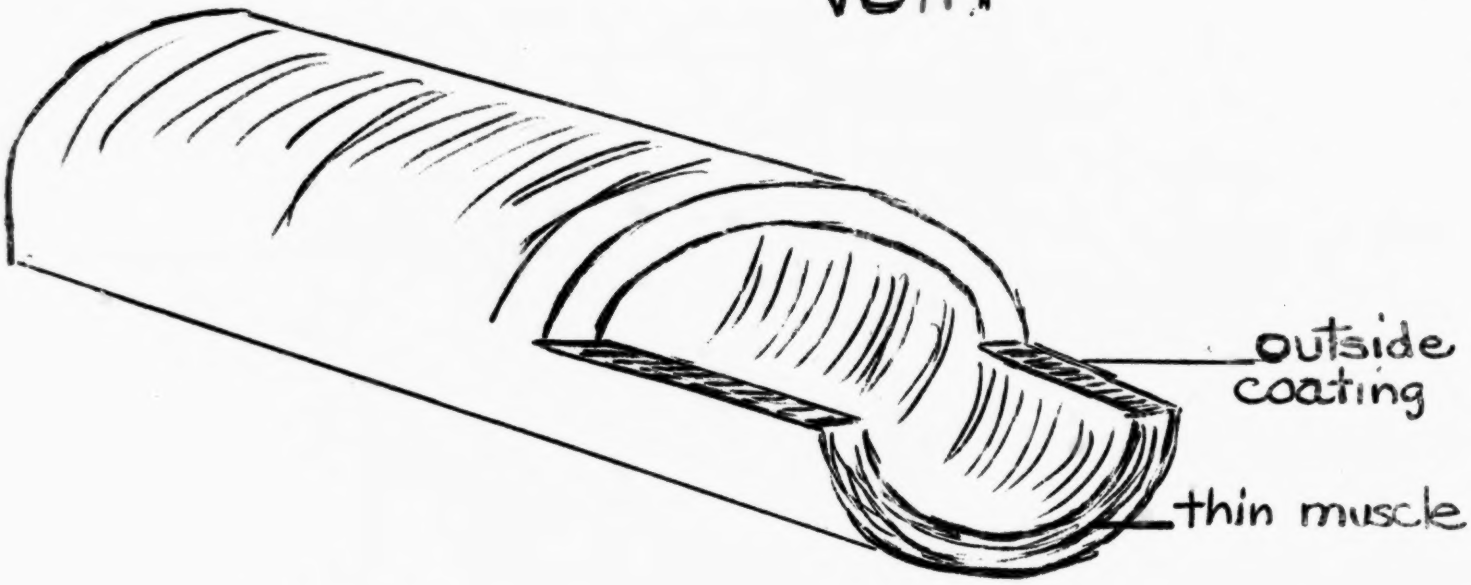
35. Leading Question: What is the difference between arteries and veins and the jobs they perform?

Materials: None

Procedure: Through research have the children discover the uses and functions of arteries and veins. Compare their construction and why they are built this way.

Models can be built from tubes and paper mache to show the difference in structure.





Vein

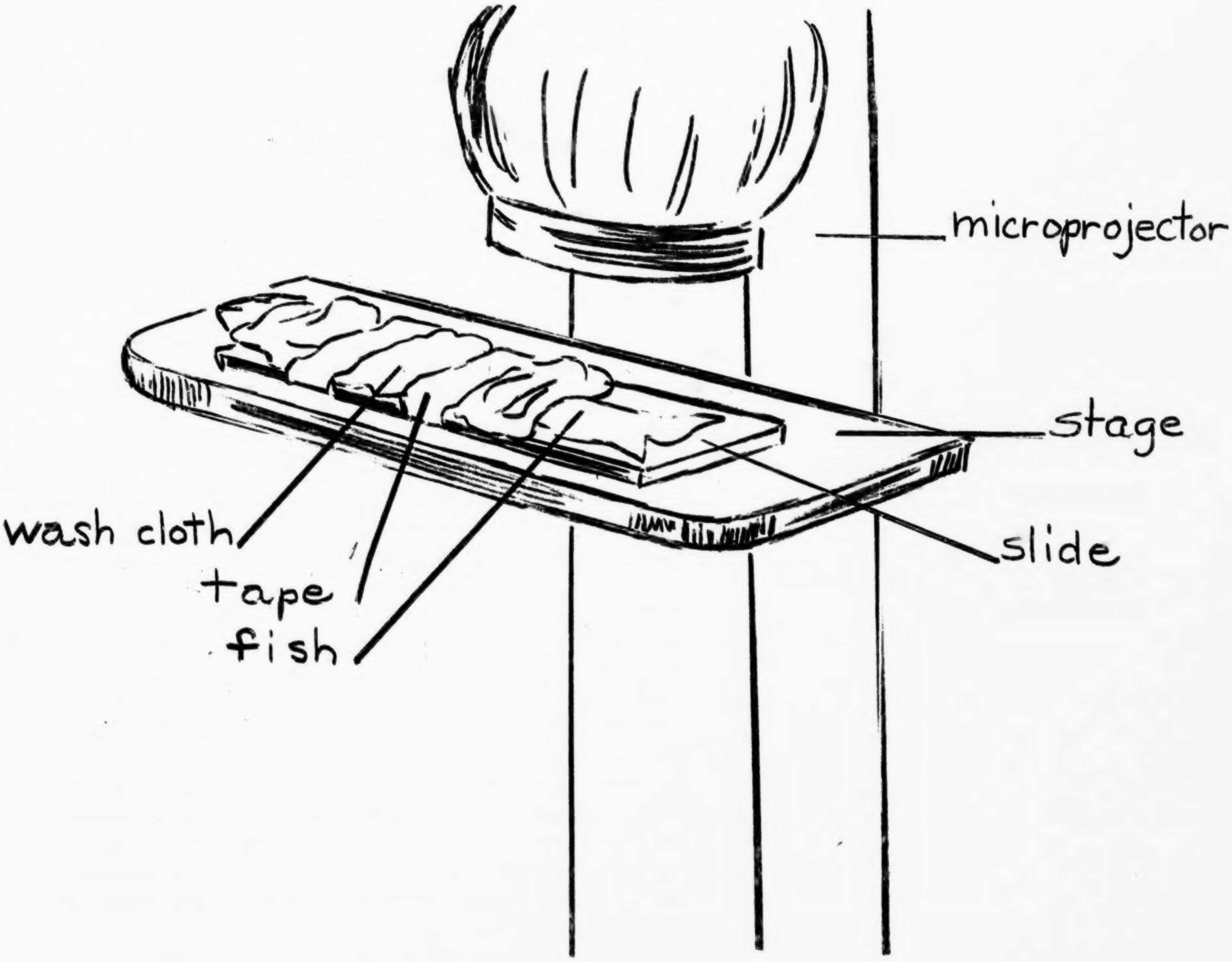
36. **Leading Question:** How does blood flow through the blood vessels?

Materials: Goldfish, microprojector, wash cloth or cotton, tape, glass slide, container of water, medicine dropper

Procedure: Wrap the gills and head of a goldfish in a wet wash cloth or cotton. Attach the wrapped fish to a microscope slide with adhesive tape as shown in the illustration. Spread the tail of the fish out on the slide. Place the slide on the stage of the microprojector so that the tail can be seen through the opening. Focus on the tail fin. Blood vessels can be seen between the bony parts of the fin. Observe the blood cells moving along inside the blood vessels. While the fish is on the slide be sure to frequently wet the cloth or cotton with water from a medicine dropper. When you can see the blood moving more slowly in the veins it is a signal that the fish is not receiving the proper amount of oxygen and it should be returned to the water. Due to the heat given off by the microprojector the fish should not be out of the water more than 2 or 3 minutes.

Discuss the size of the blood vessels and the directional flow of blood.

Note to teacher: This activity needs close adult supervision.


microprojector
stage
slide
wash cloth
tape
fish

37. Leading Question: Who are the blood characters?

Materials: Large tin can, cut out cartoon figures of blood characters

Procedure: Cover or paint a tin can red and label it BLOOD. Reach into the can and pull out a character made in a cartoon fashion whose main characteristic is a white face. Call him Mr. White Corpuscle and talk about the job in the blood.

Proceed in the above manner pulling from the "blood":

Red Corpuscle
Hemoglobin
Platelet
Plasma

This might later be used as a bulletin board display.

If you hesitate to take the task on of drawing the characters, pick one or two children talented in art and have them do it.

38. Leading Question: What characteristic of blood helps to prevent you from bleeding to death?

Materials: Glass slide, blood, needle, recording chart

Procedure: Place a drop of blood on a glass side and draw a needle through the blood every 30 seconds. When the needle begins to collect solid material the clotting has begun. Make a record of the results apparent at each 30 second interval. Include the characteristics shown by the drop of blood.

Note to teacher: Normal blood begins clotting in 2 - 3 minutes a hemophilia in about 10 minutes.

Discuss the chemical and physical changes in the blood which produce clotting. Platelets, fibrinogen and calcium should be described and compared in order to reach a decision as to what happens. Discuss a hemophilia and the problems it presents. How can blood clots be dangerous?

Blood from an animal can be used; if you decide to use human blood, be sure to sterilize any equipment.

39. Leading Question: Can you find what blood is made of?

Materials: Microscope or microprojector, sterilized needle, alcohol, slide, cover plate

Procedure: Wash the middle finger and stroke it at the tip with a sterilized needle. Draw a drop of blood and put it on a glass slide. The smear should be very thin. Red corpuscles will appear to be concave. White corpuscles, if stained, will be larger than red corpuscles, will stain differently and will have a very distinct nucleus.

40. Leading Question: Is all blood the same?

Materials: Research books

Procedure: A child or a group of children can do research in order to answer the following questions:

(1) What are the various types of blood?
(2) What happens in a blood transfusion where the blood type varies?
(3) What type of blood is a universal donor?

41. Leading Question: Is the blood a liquid or solid?

Materials: Glass, water, sand (not soil) with various size granules, tablespoon, microscope slide of blood

Procedure: Fill a glass or jar half way with water. Add one or two tablespoonsful of sand to the water. Stir the mixture with the spoon. Observe what happens to the sand when the mixture is stirred.

Remove the spoon from the mixture and observe what happens as the water slows down. What kind of sandy particles settles first? Make observations periodically.

The water represents the liquid part of the blood called plasma. The large sand granules are the red corpuscles and the smaller sandy particles are other cells in the blood. Make conclusions as to what happens in the blood stream as long as it remains in motion. When the blood ceases to flow, what happens?

Describe the appearance of blood whose flow has stopped when it was placed on a slide. Relate this to the water and sand.

42. Leading Question: What are some diseases or problems of the circulatory system?

Materials: Research books

Procedure: Have a class committee make a chart similar to the following and through research, fill in the blank areas.

DISEASES OF THE CIRCULATORY SYSTEM

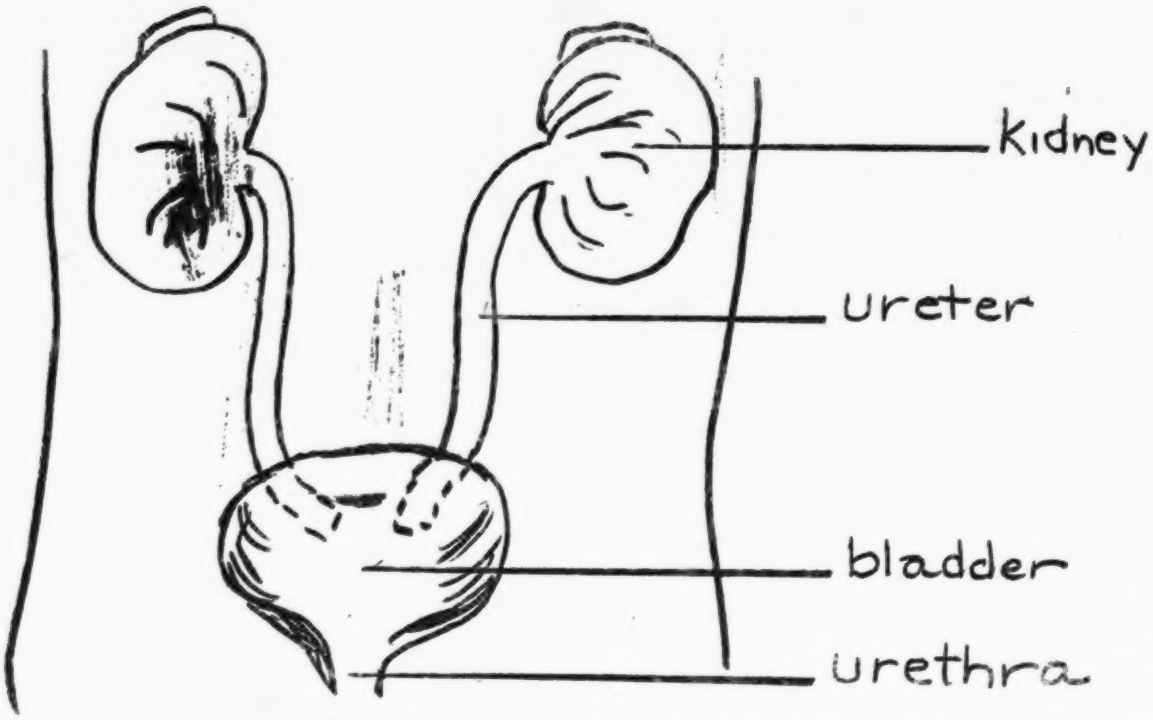
DISEASE	CAUSE	TREATMENT
Anemia		
Leukemia		
Rh factor		
Rheumatic fever		
arteriosclerosis		
embolism		
stroke		
heart structure		

You might also relate medical check-ups, diet, exercise and a sufficient amount of sleep to good practice for a healthy heart and body.

43. Leading Question: How does our body rid itself of waste?

Materials: Picture of excretory system

Procedure: With a model or picture of the excretory system, have a committee report or explain what the system consists of and its functions.



Be sure to include kidneys, ureter, bladder, urethra.

Discuss (1) How the kidneys remove waste from the blood. (2) What signal in the body says the bladder is full.

44. **Leading Question:** What function do the kidneys perform?

Materials: Sand, water, container, bucket, cheescloth or linen towel

Procedure: Mix some sand with clear water in a container Ask the class for suggestions as to how the sand can be removed from the water. Pour the mixture from the container into a bucket through a piece of cheesecloth or linen towel. Compare the results of the same process if the corners of the cloth are gathered to form a bag and the bag is squeezed in order to force the water through. Which process is faster? Compare this to the function of the kidneys.

45. **Leading Question:** What part do urine tests play in a physical examination?

Materials: Resource persons

Procedure: Have a doctor or nurse come into the classroom and explain how urine tests are conducted and the various types of information that can be obtained from such tests.

46. Leading Question: What makes up the endocrine system?

Materials: Research books, charts, pencils

Procedure: Prepare the class to do research on the endocrine system. Discuss what a gland is and formulate a definition for a ductless gland.

Lead the class to fill in the following chart after conducting research on the topics.

Gland	location	function	hyperfunction over functioning	hypofunction under functioning
Pituitary				
Adrenal				
Thyroid				
Parathyroid				
islands of Langerhans				
Thymus				
Pineal				
Gonad				

Be sure to have a picture or have the children make their own picture in order to see the location of the glands in the body. Discuss what was discovered through research.

47. Leading Question: How do we help our body to stay healthy?

Materials: Resource books, pamphlets from various health agencies

Procedure: Have a group of children do research and formulate good health rules for keeping the systems healthy. The respiratory, circulatory, nervous, digestive, excretory and endocrine should be included.

48. **Leading Question:** What is heredity?

Materials: Pictures

Procedure: Obtain pictures of two different dogs. A good example would be a very large dog, such as a boxer, German shepherd or a St. Bernard. Also get a picture of a very small dog such as a chuawawa or toy terrier. (Another good example would be a Shetland pony and a Percheron draft horse.)

Show the pictures to the class. Discuss the fact that even if the small dog is well fed and given excellent care he will never become as big as the larger dog. Ask what the reason for this is. Relate this to heredity.

49. **Leading Question:** Why are some people taller than others?

Materials: None

Procedure: Collect enough data within the class to formulate some type of hypotheses about this problem. Have every boy and girl in the class conduct a survey in his family or neighborhood. The following questions should be asked and then carefully recorded.

(1) "How tall are you?"
(2) If interviewing a man - "How tall was your father?"
If interviewing a woman - "How tall was your mother?"

When everyone has collected their data make up a class chart listing the height of each adult next to the height of his or her parent.

Study the chart and set up questions to be answered from the results. An example of such might be:

(1) How many adults are taller than their parents?
(2) How many adults are shorter than their parents?
(3) How many are about the same height as their parents?

Compute answers and make conclusions.
- (1) Are there any connections between the height of the adults and the height of their parents?
- (2) What conclusion can be made about human height?

Note to teacher:

Be sure to set up a standard with the class as to what makes someone shorter or taller than his parents. For instance, if the adult is 5'7" and his father is 5'8" does 1" make the person taller or would you call this about the same height. Think carefully on this.

50. **Leading Question:** What are dominant traits?

Materials:

Package of yeast, banana (ripened), flask, water, paper toweling, cotton, 3 bottles

Procedure:

Obtain a flask and fill it with 100 cc. of water. Dissolve ¼ package of yeast in the water. Add a piece of banana that is ripe to the solution and place a strip of paper toweling in bottle. Fruit flies will be attracted to the bottle at which time it should be plugged with cotton.

Distinguish the male fruit fly from the female. The characteristics are:

Male - has a dark bluntly rounded abdomen. On its forelegs near the head a tuft of comblike bristles can be found. It is slightly smaller than the female.

Female - has a pointed abdomen marked with several dark stripes across it. Bristles will not be found on the forelegs of most females.

Examine three males. Make a careful notation of their features. Do the same with three females. Put a male and female into a bottle, and a pair in second and third bottles. Add some more ripened banana to each bottle.

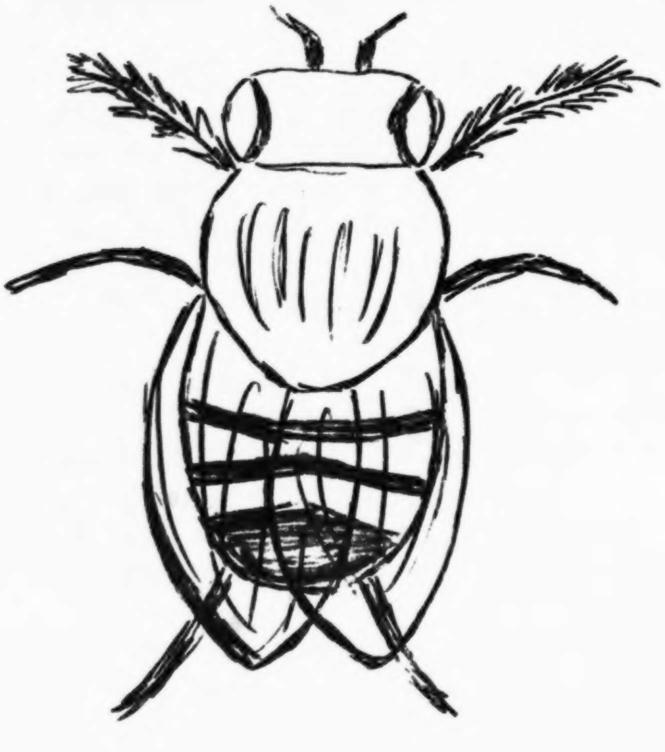
Observe carefully the young that develop. Answer the following questions and record them:
- (1) Are the traits of the young similar to the traits of the parents?
- (2) Are there any different traits?

(3) What is the eye color of the young as compared to the parents?
(4) What is the body color of the young as compared to their parents?

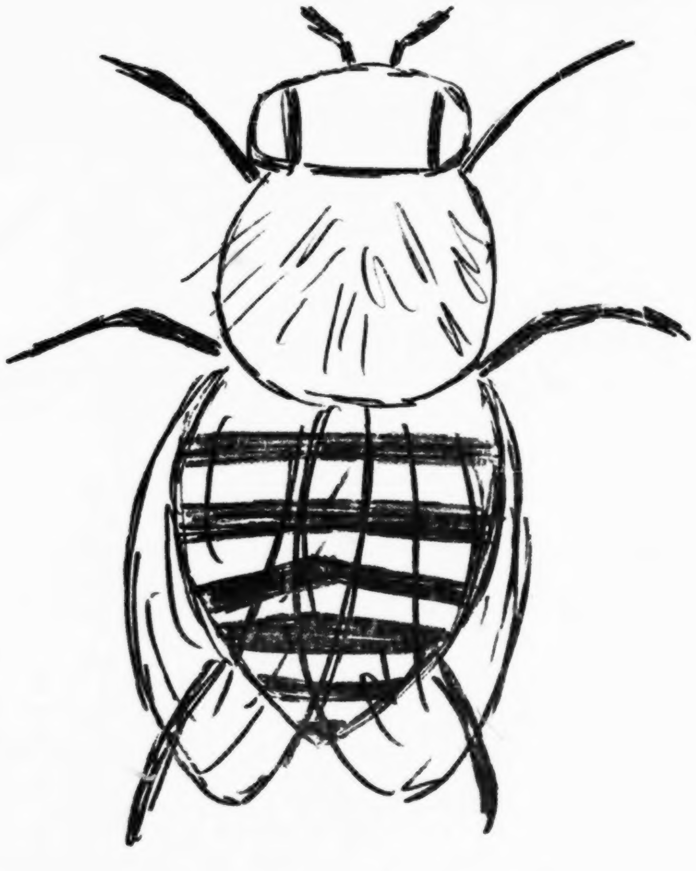
Discuss dominant and recessive traits. Cross fruit flies having gray bodies and pink eyes with flies having black bodies and red eyes and find which traits are dominant.

Note to teacher:

Fruit fly, scientifically known as Drosophila is often used in genetics for study purposes. The life cycle of the fly is about 12 days.

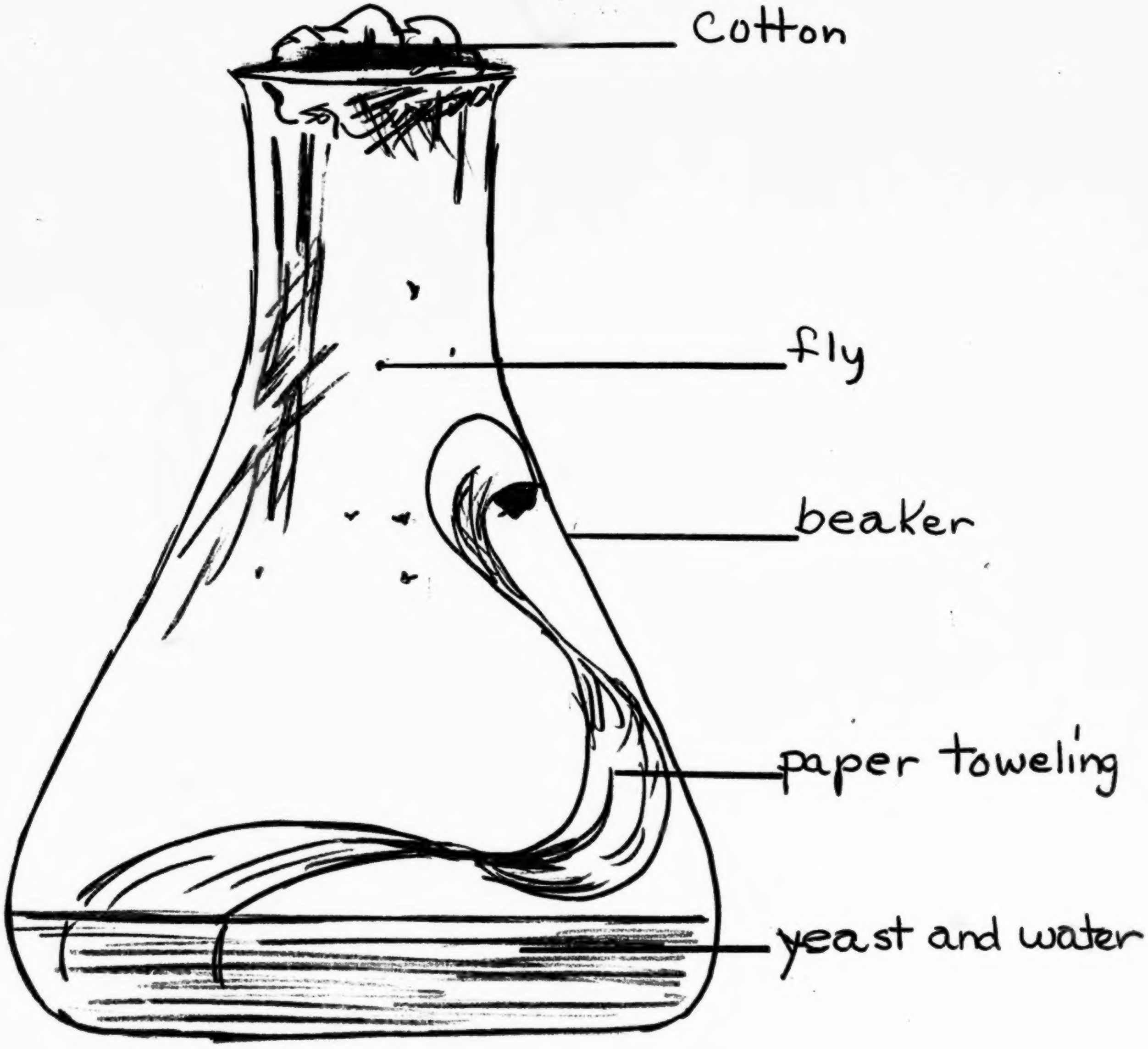


Male Fruit Fly



Female Fruit Fly

Culture of Flies


Cotton
fly
beaker
paper toweling
yeast and water

51. **Leading Question:** What is the Law of Dominance?

Materials: Research books

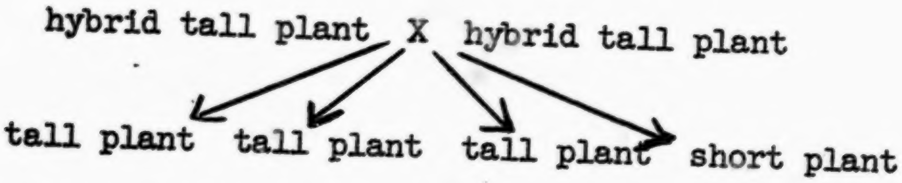
Procedure: Have a committee discover through research what a hybrid is (EXAMPLE - When 2 parents with different characteristics are crossed the offspring is a hybrid)

Short pea plant X Tall pea plant

↓

hybrid tall pea plant

How is the Law of Dominance related to this? How does this apply to the crossing of two hybrids EXAMPLE -


hybrid tall plant
X
hybrid tall plant
tall plant
tall plant
tall plant
short plant

Relate this to dominant and recessive traits. Have the children make chart showing the crossing of various hybrids. The Punneth square method helps in the solving of genetic problems. EXAMPLE:

	s	s
t	st	st
t	st	st

all st

a small (ss) plant crossed with a (tt) tall plant

A hybrid tall plant (ST) crossed with a hybrid tall plant (ST)

	S	T
S	SS	ST
T	ST	TT

Result $\frac{1}{4}$ SS
$\frac{1}{2}$ ST
$\frac{1}{4}$ TT

HUMAN BODY

GRADE 6

The Eye - The Organ of Seeing — Grade 6

UNDERSTANDINGS TO BE DISCOVERED	RELATED ACTIVITIES
The eye is round like a ball.	1A
The eye differs in color and shape.	1
The eye collects and focuses light.	1
The eye structure consists of muscles and nerves and is protected by bones.	1
The sclera, the white part of the eye, is a protective covering.	1
The cornea, the transparent front part of the eye, adjusts to various conditions of light by stretching (relaxing) and shortening (contracting.)	1, 2
The pupil, which is the opening in the iris, is a round black hole.	1
The pupil enlarges (dilates) and diminishes in size depending on the amount of light.	2
The lens is composed of a transparent material made of living cells.	1
The lens bends the rays to produce an image on the retina.	3
Muscles hold the lens in place and vary the shape.	1
The lens is convex.	1, 3
When a convex lens focuses light rays from a distant object, the image is small and inverted.	3, 4
The lens of the eye performs better than a man-made convex lens.	5
The focal point is the distance from the lens of the eye to the place where the light rays converge.	10

UNDERSTANDINGS TO BE DISCOVERED (Cont'd.)	RELATED ACTIVITIES
Both eyes are needed to provide depth perception.	6, 11
The retina is a film formed by bundles of nerve fibers.	1A, 1C
From the retina the inverted image is sent by the optic nerve to the brain.	
The rods are especially sensitive in darkness and are used in dim light.	7
The cones are affected by bright light.	
Cones enable one to distinguish color.	8
Vitreous humor fills the space between the lens and retina.	
Aqueous humor fills the space between the cornea and the lens.	
Light rays are refracted as they pass through the aqueous humor.	
Each eye has a blind spot where the optic nerve meets the retina.	9
There are six muscles attached to the outside of each eyeball.	10, 12
Tears come from the lacrimal gland.	13, 14
Eyelashes protect the eye from dirt.	14
Eyelids clean and protect.	13, 14
Hyperopia (farsightedness) occurs when the light rays focus the image behind the retina.	15
A convex lens corrects hyperopia.	15
Myopia (nearsightedness) occurs when the light rays focus the image in front of the retina and is caused by an elongated eyeball.	
A concave lens corrects myopia.	

UNDERSTANDINGS TO BE DISCOVERED (Cont'd.)	RELATED ACTIVITIES
Astigmatism occurs when either the cornea or the lens is shaped irregularly.	16
Special ground lenses correct astigmatism.	
Cross-eyedness occurs when one eye pulls toward the other eye.	
Lenses and exercises and, in extreme cases, operations can correct this.	
Wall-eyedness occurs when an eye pulls more toward the side. Lenses and exercises and, in extreme cases, operations can correct this.	
Proper diet, exercise, and rest are needed for good, healthy eyes.	17
A person with an eye problem should seek the advice of the proper eye specialist.	18

The Eye - The Organ of Seeing

Grade 6

ACTIVITIES

1. Leading Question: What is the eye?

   A. Materials: Eye model, body model

   Procedure: Contact the Science Materials Center for eye model and body model. Allow the children to carefully examine the structure of the eye and describe the functions of each part.

   B. Materials: All students as demonstrators and observers

   Procedure: Have each child examine each other's eyes to see differences in shapes and colors.

   C. Materials: Transparencies on eye and camera

   Procedure: Contact Instructional Materials Office for eye transparencies with camera overlays.

2. Leading Question: Oh where, oh where has my pupil gone?

   A. Materials: Student demonstrators, darkened and lighted areas within classroom, possibly a magnifying glass

   Procedure: Have a student stand in an area with little light exposure. Have a partner observe the size of the pupils. Now have the same demonstrator move into the sunlight or close to a lighted window and have the same partner observe the size of the pupils now. Compare the size in both situations. A magnifying glass can be used to enable viewing the change easily and readily.

   B. Materials: Student demonstrator, book, paper, rubber band, mirror

   Procedure: Have demonstrator roll ten or twelve sheets of paper so that each sheet goes around the roll twice. Hold the roll together with the rubber band. Set the roll upright on an open book, pressing it tightly against the print so as not to admit any light in the bottom of the roll. Press an eye tightly against the top of the roll. A few sheets might have to be added so that it is impossible to read the print at first. While one eye is closed, keep looking through the roll, keeping all light out. Let the class predict what will happen. When the print becomes visible, have the demonstrator quickly look into mirror and observe and relate to the class what change, if any, occurred in the eyes. Keep watching the eyes. As more and more light enters the eyes, what happens to the pupils?

Encourage the children to suggest advantages of this ability of the pupils in the eyes to change in size. (Contraction protects the eyes from bright light; enlargement enables one to see in dim light; adjustment of pupils aids in avoiding danger.)

3. **Leading Question:** How are the eye and camera similar?

Materials: Two milk cartons, convex lens, knife, five-inch piece of wax paper, cellophane tape, piece of dark construction paper

Procedure: Take off the top end of one carton. At the bottom of same carton, cut off a piece slightly smaller than the size of the convex lens. Tape the lens over this opening. From the top end, cut the four corners to about an inch-and-a-half away from the bottom of carton. Take off the top end of second carton. Cut a large square out of bottom of same carton, then cover it with wax paper and tape to carton. Slip the second carton into first carton and the camera is complete. To keep out light, a piece of construction paper can be wrapped around and taped to outside carton.

4. **Leading Question:** Why does the convex lens cause distant objects to appear small and inverted?

A. Materials: Magnifying glass, source of light (preferably window sill with landscaping out of window or object on sill), piece of white paper or cardboard, ruler

Procedure: This experiment will show up more easily if room is darkened, except for light exposure from window. Hold the lens between window and paper or cardboard. Move the lens forward and backward until object is in sharp focus. Have the children observe the picture onpaper of the object in focus and relate what is seen on paper. Suggest the image on paper be measured and compared with the measurements of the real object.

B. **Materials:** Same as above

Procedure: Same as above with one added step; that is, measure the distance between the lens and paper or cardboard and ask the children if they can produce suggestions why the distance might be called a focal length. (It is the distance at which distant objects are in focus.)

C. **Materials:** Source of light (film strip projector), a big dark letter (one with horizontal and vertical lines) on white paper or cardboard, convex lens, plain white paper or cardboard, ruler

Procedure: Illuminate letter with the source of light. Then hold plain piece of paper to side and in front of illuminated letter. Place lens in front of plain paper. Move lens and paper until a sharp image of object (letter) is on screen or retina. Then measure and compare sizes of lines on retina and on object. Why aren't Q, O, and C good illustrated letters to use?

5. **Leading Question:** Is there a true substitute for the eye?

Materials: Student demonstrator

Procedure: Have demonstrator stand at the farthest point from source of light in activity #4, then have him move closer and closer to object to be focused (object on window sill or landscaping scene from outside). Let him relate any change in sharpness, blurriness, or size of object.

6. **Leading Question:** Why do we need two eyes?

A. **Materials:** Chair, student demonstrator

Procedure: Have student hold up a thumb about a foot in front of the eye. Close one eye. With the opened eye, look at the chair so that it is easily seen. While still looking at the chair, how does the image of the finger appear? Now focus vision on getting a clear image of the finger. How does the image of the chair appear?

B. Materials: Student demonstrator, fountain pen with cap

Procedure: Have the demonstrator hold the cap at arm's length in one hand in front of him, while the other hand is holding the open pen, point up, at arm's length. Let the class predict what will happen if the demonstrator were to close one eye and put on the cap as quickly as possible in one movement. Then have activity demonstrated with one eye open. Repeat activity with both eyes open.

C. Materials: Two pencils with rubber-tipped ends, two index fingers

Procedure: Do above activity with objects about three feet apart in one quick movement with one eye open then two eyes open.

D. Materials: Sheet of paper, student demonstrator

Procedure: Have student roll the paper into a tube about an inch in diameter. Hold the tube against the right eye with the left hand at the end of the tube by the right eye while the left arm is extended in front of and across the left eye. Look with both eyes. Do you see the same portion of the hand through the tube that you see with the other eye?

7. Leading Question: Do your eyes ever fail you?

Materials: The class as demonstrators

Procedure: Have children look toward a very lighted area for a short period of time, then immediately into a very dark area. What happens? (Temporary blindness occrus until visual purple is built up again in the retina.)

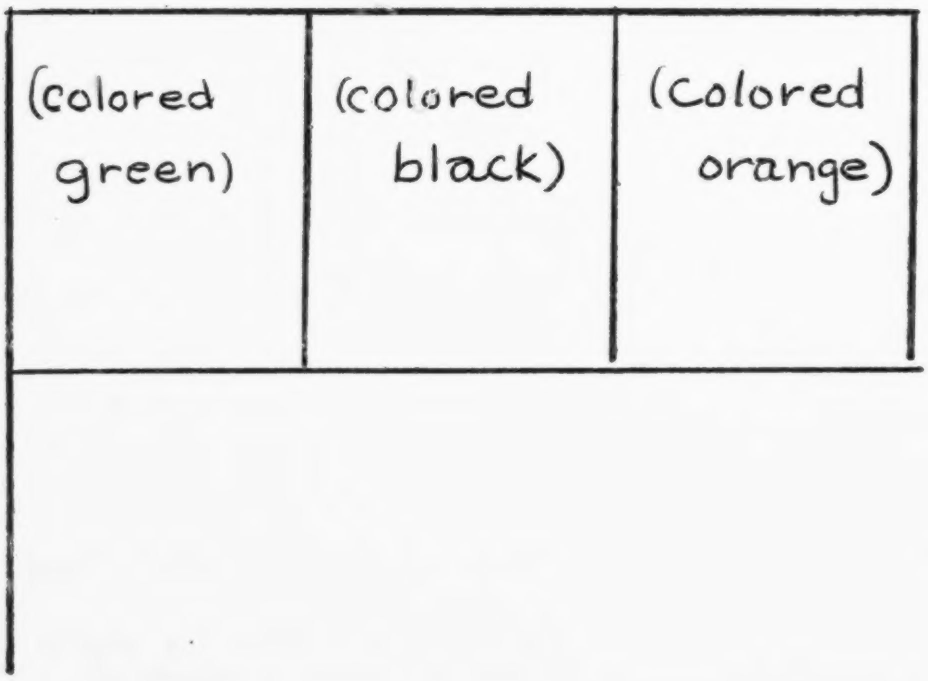
8. Leading Question: Do you continue to perceive an image after the eyes have stopped focusing on the object?

Materials: Pictures as shown on illustration form

Procedure: Stare at the flag for at least a half minute, then concentrate on what the eyes are focusing. Then stare at the empty box. What do you see in the box? Did you recognize the flag? Can you tell why you saw something?

Note to teacher:

There are still many uncertainties about these cones contributing to our perception of color. Some scientists believe that color exists in one's head and not on objects perceived.


(colored green)
(colored black)
(Colored orange)

9. Leading Question:	Can I always see everything in front of me?
Materials:	Sheet of paper with a colored cross (+) and a circular dot (●), student demonstrator
Procedure:	Have both marks, as stated above, on a piece of paper in a horizontal line with a little distance between the two spots. Have student close left eye while the right eye looks at the cross on the paper. Move the paper very slowly forward and backward until you come to a point where the black dot disappears. Repeat, closing right eye while opened left eye focuses on dot.
10. Leading Question:	Who says I don't have eyes in back of my head?
Materials:	Student demonstrators, any object
A. Procedure:	Let one student volunteer to be a performer while another volunteers to be a tester. The tester will sit on a chair with head forward and still, while the performer stands behind him holding an object at tester's eye level. The performer slowly moves object forward at one side of tester. When the tester first discovers any motion he says, "Stop!" Have performer observe where the object becomes visible to tester. Repeat same activity on the other side of tester. Each child can experience the role of tester and performer to check range of side vision.
B. Procedure:	Have children sit in their seats and relate what can be seen by moving both eyes in all directions, keeping head straight. What makes this possible?
11. Leading Question:	You mean my eyes are muscle-bound? Why don't your eyes slip out of place?
A. Materials:	Entire class as demonstrators and observers
Procedure:	Let the class divide themselves into groups so each has a partner. One student observes while partner keeps his head still, moving eye upward, downward, to both sides, and around. Try same movements by moving the

head only, thus keeping the eyes absolutely still. (This may take practice.) Why are you able to move your eye without head motion? Does the eye wander without control? Have each child play the part of performer and viewer.

B. Materials: Student demonstrator, two sheets of paper, classroom of students

A. Procedure: Have demonstrator roll two tubes from paper about $1\frac{1}{2}$" in diameter and let him place one in front of each eye. Have him walk around the room and let him relate the value in seeing other objects than just those directly in front of him. Compare with activity below.

B. Procedure: Have student stand in front of room to relate the names of all the children he can see by looking straight ahead without moving the head.

12. **Leading Question:** Do both eyes perceive an object the same way?

Materials: Round can with a printed label on it, demonstrator

Procedure: Set the can on table or desk top about ten to twelve inches from eye level of demonstrator. Have demonstrator look at label with both eyes. Then, in rather rapid successions, have him close one eye simultaneously while opening the other eye. Let him continue this activity for a few seconds. Does the right eye see exactly what the left eye sees? What causes the difference?

13. **Leading Question:** Who says you can make me cry?

A. Materials: Student demonstrator

Procedure: Have demonstrator rub one eye while another student observes what happens. Where are the tears coming from?

B. Materials: Student demonstrator, onion

Procedure: Have student grate an onion. Let class observe what forms. Have demonstrator describe feeling before and after the tears appear. Where do the tears go?

14. Leading Question: Must I blink?

Materials: Student demonstrators

A. Procedure: Instruct a student to clap his hands in front of the demonstrator's face. What happens to demonstrator's eyes? How can this reaction aid the eyes? Encourage discussion in the value of the tears brought about by blinking. Discuss other reasons for blinking.

B. Procedure: Have a student record the time another student can keep from blinking. This experiment should aid the child in awareness of the necessity of blinking.

15. Leading Question: Can hyperopia be corrected?

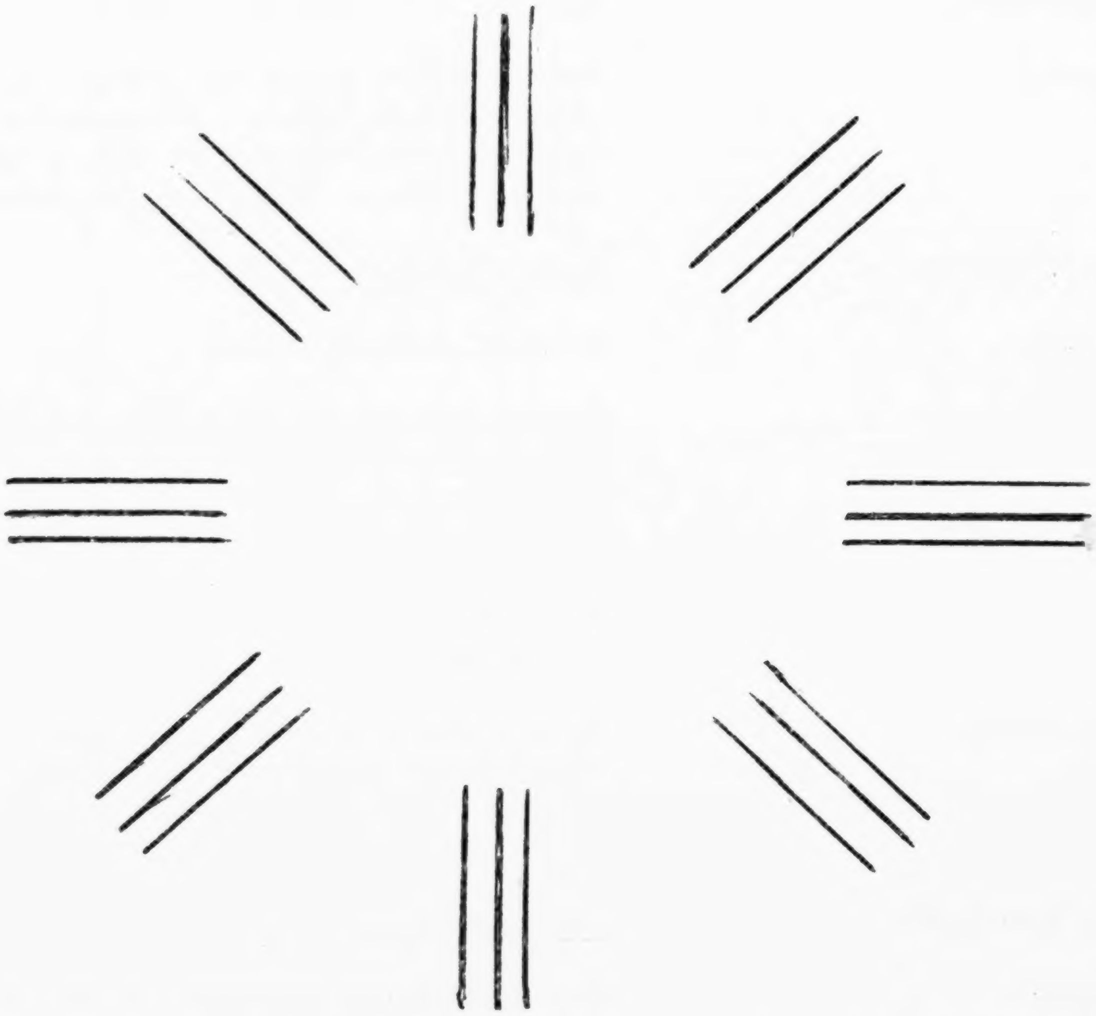
Materials: Two magnifying glasses or two convex lenses, student demonstrator

Procedure: Have child focus an object using one convex lens. Then move lens slightly toward the object until blurriness occurs. Have child experiment and demonstrate where to put the other lens in order to sharpen the focus of object. (Object might have to be adjusted slightly. The kind of convex lens has a lot to do with the success of this demonstration.)

16. Leading Question: How can we detect astigmatism?

Materials: Illustrated test of astigmatism, demonstrators

Procedure: Have child look at the test of astigmatism with the bare eye. Have him describe if he sees each line with equal light intensity or if some are darker and lighter than others. Do this once the group has a little knowledge of eye defects, but make sure one does not imply any diagnosis.



17. Leading Question: Are there good eye care habits to use?

Materials: Science and health references

Procedure: Have children list a set of rules about good eye care. This is available in the bibliography.

18. Leading Question: Won't one do the job? Why can't I get my glasses at the 5¢ and 10¢ store?

Materials: Science reference materials, dictionaries

Procedure: Lead children to discussion and purpose of the following specialists: opthalmologist, oculist, optometrist, optician.

HUMAN BODY

APPENDIX

I. IMPORTANT MINERALS

MINERAL	FUNCTION	SOURCE
Calcium	Building and maintaining strong bones and teeth. Necessary for chemical reaction in blood clotting and in process whereby iron is incorporated in hemoglobin. Helps maintain normal heart action.	Milk, eggs, cheese, beans, peas, and most cereals.
Phosphorus	Building strong bones, teeth and other body tissue. Necessary for formation of ATP and chemical processes in muscular contraction. Present in DNA and RNA.	Milk and dairy products, meats, and cereals.
Iron	Essential in formation of hemoglobin in blood cells. Oxygen combines loosely with hemoglobin and is carried to the cells.	Liver, green vegetables, egg yolk, beef, beans, enriched bread, and cereals.
Copper	Enables red blood cells to use iron.	Liver, fowl, leafy vegetables and whole grains.
Iodine	Needed for proper function to the thyroid gland. Lack of iodine in the diet may cause an enlargement of the thryoid gland called goiter.	Sea food and iodized table salt.
Sodium	Necessary for maintaining cell permeability. Functions in transmitting nerve messages.	Table salt.
Chlorine	Chlorine forms a part of hydrochloric acid, necessary for digestion. Present in blood and enters into process whereby carbon dioxide is carried by red blood cells.	Table salt.

II. IMPORTANT VITAMINS

VITAMIN	FUNCTION	SOURCE
A (Fat soluble)	Protects against infections of nose, throat, and other ephithelial tissues. Protects against certain eye infections Mild deficiency causes night-blindness or inability to see in dim light.	Present in food that is yellow in color--butter, carrots, egg yolks, cheese, apricots and fortified margarine. Occurs in leafy green vegetables, green beans, peppers, and liver and fish liver oils. When more vitamin A is eaten than is needed, it is stored in the liver, lungs, and kidneys.
B-1 Thiamin (Water soluble)	Essential for digestion and absorption. Lack of B-1 causes improper oxidation of foods, especially carbohydrates. Necessary for a healthy nervous system. Lack of B-1 may cause beriberi, a nervous disorder.	Found in pork, liver, and lean meats; whole grain cereals and enriched bread; and beans and peas.
B_2 or G Riboflavin (Water soluble)	Necessary in cell respiration and nerve functioning.	Sources include lean meats, liver, kidneys, milk, and whole grain cereals.
Niacin or Nicotinic Acid (Water soluble)	Maintains healthy skin and nerves. Aids in digestion. A severe deficiencyof niacin causes pellagra--the skin becomes rough and red, and the tongue red and sore.	Present in lean meats, especially liver and heart; eggs; milk; nuts; whole grain.
C Ascorbic Acid (Water soluble)	Lack of vitamin C causes swollen painful joints and bleeding under the skin. Necessary in maintenance of tissues, healing of injuries, and cellular respiration.	Found in oranges, lemons, limes, grapefruit, tomatoes, strawberries, cantaloupes, greenpeppers, and cabbage.
D The sunshine vitamin (Fat soluble)	Essential for the body to use calcium and phosphorus to build bones. Lack of vitamin D can cause rickets, a deficiency of the bones.	The body produces vitamin D in the skin when exposed to the sun. Milk, eggs, and liver contain very small amounts. Some foods are irradiated with ultra-violet lights to add vitamin D. Cod liver oil is a good source of vitamin D.

VITAMIN	FUNCTION	SOURCE
K (Fat soluble)	Necessary for normal clotting of blood.	Vitamin K is found in leafy vegetables, cabbage, cauliflower, tomatoes, egg yolks, and liver. It is synthesized in the intestines of man.

III. SIX CLASSES OF NUTRIENTS NEEDED BY THE BODY

Nutrient	Composition	Use in the body	Source
Carbohydrates (Starches and Sugars)	Carbon, hydrogen and oxygen	The chief source of energy. Excess carbohydrates are stored for future use in the form of glycogen or converted to fat.	Sugars: molasses syrups, fruits, honey, refined sugar, candy, and sweet desserts. Starch: potatoes, rice, cereal, breads, cakes, cookies, peas and beans.
Fats and Oils.	Carbon, hydrogen and oxygen.	Supply energy. Excess fats and oils are stored for future use.	Fat meats, bacon, cream, butter, nuts, cheese, fish and liver oils.
Proteins	Nitrogen, plus carbon, hydrogen, and oxygen. Some proteins contain iron, sulfur, phosphorus, or other elements.	Essentially for growth and repair. Supply small amounts of energy.	Milk,eggs, lean meats, cheese, dry peas, beans, and nuts.
Water	Hydrogen and oxygen	Water makes up a large part of protoplasm; the largest part of the blood is water.	Most foods particularly fruits and other vegetables. Milk and other beverages.
Minerals	Calcium, phosphorus, sodium, iodine and iron.	Body structures and functions.	Meats, poultry, cereals, milk, vegetables, nuts, and salt.
Vitamins	Carbon, hydrogen, oxygen and other elements present in specific vitamins.	Special regulatory functions and components of certain enzymes.	Meats, milk, whole grains, vegetables and fruits.

IV. DIGESTION SUMMARY

Parts of Tract	Digestive Juice	Changes in food
Mouth	Saliva	Some starches to sugar.
Esophagus	None	Food passes to stomach.
Stomach	Gastric Juice: 1. Pepsin (enzyme) 2. Rennin (enzyme) 3. Hydrochloric acid (not an enzyme)	Protein digestion begins.
Intestine	Pancreatic juice: 1. Trypsin (enzyme) 2. Amylase (enzyme) 3. Lipase (enzyme) 4. Bile (contains no enzymes) 5. Intestinal juice (contains digestive enzyme)	Digestion of food is completed: 1. Proteins to amino acids. 2. Starch and complex sugar to simple sugar (glucose), and 3. Fats to fatty acids and glycerin.

V. "THE BASIC FOUR" (formerly "The Basic Seven")

Group I	Breads and Cereals (4 or more servings daily) Enriched bread and whole grain bread Flour Cereals Potatoes
Group II	Meats (2 or more servings daily) Meat Poultry Fish Eggs Legumes
Group III	Vegetables and Fruits (2 fruits and 2 vegetables daily) Fruits, including citrus Vegetables, including green, leafy, and yellow
Group IV	Milk (adults - 2 or more cups of milk or its equivalent daily; children - 2 to 4 cups of milk or its equivalent daily) Milk Cheese Ice Cream